AD-A143 292 DEFENSE COMMUNICATIONS AGENCY COST AND PLANNING FACTORS 1/2
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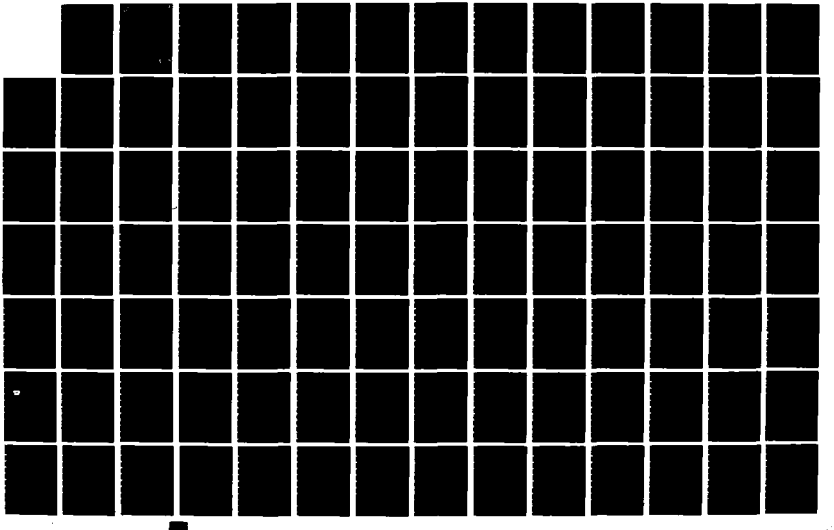

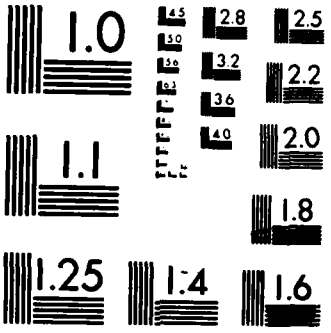


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DEFENSE COMMUNICATIONS AGENCY
WASHINGTON, D. C. 20305

DCA CIRCULAR 600-60-1
Change 1

11 June 1984

ANALYSIS

Defense Communications Agency
Cost and Planning Factors Manual

AD-A128664

1. DCA Circular 600-60-1, 4 March 1983, is changed as follows:

a. Page viii, under "Page". Change "10-21" to "10-23".

b. Page 11-6. Delete the entire first line and the words "be used. Each" in line 2.

c. Remove the superseded pages and insert the enclosed new pages as indicated below:

| REMOVE PAGES | INSERT PAGES |
|---|---|
| xi through xx | xi through xx |
| 10-13 through 10-24 | 10-13 through 10-26 |
| 11-11, 11-12 | 11-11, 11-12 |
| 14-11 through 14-14 | 14-11 through 14-14 |
| 16-1 through 16-3 | 16-1 through 16-4 |
| 21-7, 21-8 | 21-7, 21-8 |
| 22-1, 22-2 | 22-1 |
| 23-5 through 23-7 | 23-5 through 23-7 |
| 24-3 through 24-6 | 24-3 through 24-6 |
| 24-19, 24-20 | 24-19, 24-20 |
| 24-29, 24-30 | 24-29, 24-30 |
| 24-33, 24-34 | 24-33, 24-34 |
| 24-41 through 24-52 | 24-41 through 24-52 |
| 24-55, 24-56 | 24-55, 24-56 |
| 28-3 through 28-12 | 28-3 through 28-12 |
| 31-1 through 31-17 | 31-1 through 31-14 |
| 38-1 through 38-6 | 38-1 through 38-6 |
| | 39-1 through 39-8 |
| I-1 through I-9 | I-1 through I-9 |

The changed portions are indicated by number signs (#) in the left margin of the new pages.

OPR: 690
DISTRIBUTION: Special

2. When the above action has been completed, this change may be filed with the basic publication.

FOR THE DIRECTOR:

KENNETH H. CAMPBELL
Colonel, USA
Chief of Staff

1 Enclosure a/s

CONTENTS (CON.)

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# ILLUSTRATIONS

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## DEFINITIONS AND GLOSSARY OF TERMS

Antenna Systems (Line of Sight). Parabolic reflectors and feed horns (usually quoted as one item), radomes, antenna mounts, and passive reflectors, if used.

Assembler. Employee whose primary duty is to convert individual components to make an assembly or subassembly. Works with preformed jigs, harnesses, and fixtures. Manual dexterity is required.

Associate Engineer. An action officer working under supervision in a professional capacity but making only minor decisions which are subject to review.

Commercial Documentation. Documentation based upon the DoD Authorized Data List (referred to as TD-3) required to manage and develop a capability to support equipment of a commercial nature, with contractor assistance in some cases. Verified contractor publications overhaul, etc., are included.

Computer Programers I, II, and III. Computer Programer III is a fully qualified journeyman performing the same functions as the Senior Computer Programer, but with no supervisory responsibilities. Computer Programers I and II are of a less skilled classification and are closely supervised.

Computer Systems Specialist. Technically trained employee specializing in the selection and integration of computer components to match the operating characteristics and capabilities of the operating system.

Constant Dollars. Costs expressed in terms of the value of a dollar in a specified base year.

Cost-of-Living Allowance. This allowance is made to compensate for the difference existing between the adjusted annual pay rate and the prevailing standard of living in a particular geographical area.

Current Year Dollars. (Also "then year" or "inflated dollars.") Costs expressed in actual amounts, including any amounts due to economic price level changes.

Degree-day. A unit of heat measurement equal to $1^{o}$ of variation below a standard temperature of the average temperature of 1 day.

Development Tests. The test planning and use of prototype equipment to acquire engineering data and confirm engineering hypotheses.

Direct-Hire Foreign National Personnel. Non-U.S. citizen personnel employed by the U.S. Forces overseas. Pay rates determined by the U.S. Forces are

TABLE 10-6. TROPO RADIO EQUIPMENT

| Frequency (GHz) | XMTR Output (kW) | Cost |
|---|---|---|
| 1 | 1 | $243,000 |
| | 10 | 303,000 |
| 2 | 1 | 245,000 |
| | 10 | 309,000 |
| 4 | 1 | 249,000 |
| | 10 | 319,000 |

NOTES: Base year is pre-1970.
Includes 2 power amplifiers, 2 exciters, 4 receivers with combiners, 4 parametric amplifiers, 1 fault indicator, and 1 performance monitor.

TABLE 10-7. TROPO ANTENNA EQUIPMENT

| Antenna Size | Concrete Foundations* | Cost Per Antenna** |
|---|---|---|
| 15-ft dia. w/50-ft tower | $ 700 | $ 12,100 |
| 30-ft dia. w/ground mount | 2,800 | 20,800 |
| 60-ft dia. w/ground mount | 11,200 | 37,200 |
| 85-ft dia. w/ground mount | 23,600 | 74,300 |
| 120-ft dia. w/ground mount | 36,000 | 143,300 |

NOTES: Base year is pre-1970.
*Concrete ground mounts in place. This cost should be included in site activation.
**Feed horn and mounting are included in cost.

TABLE 10-8. FEED SUBSYSTEM COST

| Frequency (GHz) | Antenna Size | | |
|---|---|---|---|
| | 15 ft & 30 ft | 60 ft & 85 ft | 120 ft |
| 1 | $9,075 | $11,345 | $14,040 |
| 2 | 6,725 | 9,065 | 12,580 |
| 4 | 4,980 | 7,250 | 11,190 |

NOTES: Base year is pre-1970.
Costs are for 2 antennas @ 100 ft from radio building. Feed horn and mounting are included in antenna subsystem (table 10-7). Feed subsystem prices include waveguide, waveguide bridge (supports), pressurization/dehydration equipment and hardware.

4. High-Frequency Radio Equipment. (Tables to be published at a later date.)

5. Satellite Systems. This paragraph contains tables of equipment costs and cost-estimating relationships for geosynchronous satellite communications systems. They are presented in three subparagraphs: satellites, launch vehicles, and earth terminals.

a. Satellites.

# (1) Cost Considerations. While many satellite systems exist, more complex military and commercial satellites are currently being orbited. The method for estimating the cost of future satellite systems proposed herein has been developed by the Space Division of the U.S. Air Force Systems Command, based on the historical costs of previous satellite programs. It is described in the Space Division Technical Report TR 81-45 of June 1981 entitled, "Unmanned Spacecraft Cost Model" (fifth edition), which should be consulted if this cost-estimating technique is to be employed. The Space Division developed separate CER's for the nonrecurring cost (mainly RDT&E) and for the first unit of the production run. Costs of second and subsequent units may be derived from the first unit by application of a 95 percent cumulative average learning curve. (See chapter 37 for a discussion of learning curves.). The subsystems for which the Space Division developed CER's are:

(a) Dispenser--the structure which connects multiple spacecraft and injects them into orbit.

(b) Interstage--the booster adapter or separation mechanism between the booster and spacecraft when there is no dispenser. For modeling purposes, this is considered part of the structure.

(c) Structure--provides the support and mounting surfaces for all equipment and bears the majority of spacecraft stress loads.

(d) Thermal Control (TC)--maintains the temperature of the spacecraft platform and mission equipment within allowable limits in certain orbital conditions. For modeling purposes, this is considered part of the structure.

(e) Propulsion (Apogee Kick Motor (AKM))--provides reaction force for a final maneuver into orbit and orbit changes.

(f) Tracking, Telemetry, and Command (TT&C)--measures platform conditions; processes, stores, and transmits the data to the ground; receives and processes commands from ground and initiates their execution; and provides for tracking.

(g) Communications Subsystems--performs transmission repeater and signal conditioning function. The signal or transmission received from the ground may be amplified or reconfigured before retransmission, or both. (Separate CER's have been developed for the antenna only, electronics only, and combined communications package.)

(h) Electrical Power Supply (EPS)--generates, converts, regulates, stores, and distributes all electrical energy to and between spacecraft components.

(i) Attitude Control System (ACS)--maintains the spacecraft in the required orbit and maintains the correct attitude and direction of determined axes within that orbit.

(j) Aerospace Ground Equipment (AGE)--includes ground support equipment, in-plant equipment, special tools and test equipment, and any associated nonhardware effort.

(k) Launch and Orbital Operations Support (LOOS)--includes any effort associated with planning for and execution of the launch and orbital operations effort.

(l) Program Level--includes those accounts for program management, reliability, planning, quality assurance, systems analyses, project control, and other costs that cannot be related to any specific cost element.

(2) Cost-Estimating Relationships (CER's). The CER's usually relate the subsystem weight in pounds to the subsystem cost in thousands. Appropriate factors from chapter 38 must be applied to obtain cost estimates for years other than the base year stated. Selected CER's are given in table 10-9 and table 10-10. The Space Division has also normalized some of the CER's by subjective correction for technology carryover and complexity of design. (For a complete description, see the Space Division TR on file # in Code 690.) For each CER, the standard error of the estimate is shown. Use of this standard error is explained in chapter 46.

(3) Use of the Tables. To obtain a cost estimate using the relationships in either table 10-9 or table 10-10, first obtain an estimate of the independent variable. If the value of the independent variable is outside the stated allowable range, the CER may produce incorrect results. Enter the value of the independent variable in the expression for the estimated cost of that subsystem. The result is the estimated cost in thousands of dollars. Estimates must be secured for each of the subsystems in the satellite. To obtain the total cost of the program, an estimate must be obtained for both the fixed (nonrecurring) and variable (production costs). The estimated fixed cost is the sum of the nonrecurring cost estimates of the subsystems. The estimated cost of the first production unit is the sum of the first unit cost estimates of the subsystems. Subsequent production units are costed from the first unit by learning curves # (chapter 37). Program level costs and fees are added. Total costs must be translated to the appropriate year as explained in chapter 38.

(4) Example. The following example is abstracted from Space Division's manual to indicate how the technique may be applied. The Space Division manual should be used for actual cost estimation.

# (a) Assume a synchronous communications satellite with design weight as follows:

| Item | Pounds |
|---|---|
| Dispenser | Not required |
| Structure and Interstage | 200 |
| Thermal Control | 30 |
| Communications | 240 |
| TT&C | 80 |
| EPS | 320 |
| Attitude Control (dry) | 150 |
| AKM | Not required |
| AGE | Not required |
| LOOS | Not required |

# TABLE 10-9. COMMUNICATIONS SATELLITE CER's (Nonrecurring Cost)

| Subsystem | CER ($K)* | Standard Error ($K) | Range |
|---|---|---|---|
| Structure, TC, and Interstage | $1100 + 91 \times W^{.67}$ | 1780 | $15 \leq W \leq 940$ |
| TT&C | $705 + 34.8 \times W$ | 1110 | $8 \leq W \leq 250$ |
| Comm Antenna | $243 \times W^{.58}$ | 706 | $15 \leq W \leq 190$ |
| Comm Electronics | $207 \times W^{.7}$ | 2680 | $29 \leq W \leq 320$ |
| Combined Communications and TT&C | $2,100 + 234 \times W^{.69}$ | 2910 | $26 \leq W \leq 610$ |
| Attitude Control | $834 + 60.3 \times W$ | 2270 | $3 \leq W \leq 310$ |
| Electrical Power Supply | $2100 + .034 \times (W \times P)^{.93}$ | 1480 | $9 \leq W \leq 620$<br>$25 \leq P \leq 1640$ |
| AKM (1-Axis) | $223 + 10.8 \times I$ | 883 | $44 \leq I \leq 410$ |
| Platform (w/o Comm) | $7410 + 22.6 \times W$ | 6650 | $56 \leq W \leq 2000$ |
| Program Level | $357 \times C$ | 3750 | $14 \leq C \leq 120$ |
| Dispenser | $9.05 \times W$ | 267 | $32 \leq W \leq 247$ |
| AGE | $113 \times T$ | 1940 | $10 \leq T \leq 120$ |

* Base year is FY 1979.
W = subsystem weight (in lb)
P = BOL power (in watts)
I = impulse (in thousands of lb-sec)
C = platform cost (in $M)
T = nonrecurring plus first unit cost (in $M)

Source: Space Division SD-TR-81-45, "Unmanned Spacecraft Cost Model," fifth edition, Jun 81.

TABLE 10-10. COMMUNICATIONS SATELLITE CER's
(Cost of First Production Unit)

| Subsystem | CER ($K)* | Standard Error ($K) | Range |
|---|---|---|---|
| Structure, TC, and Interstage | $19.4 \times W^{.66}$ | 501 | $15 \leq W \leq 1{,}700$ |
| TT&C | $14.1 + 33.0 \times W^{.91}$ | 593 | $8 \leq W \leq 250$ |
| Comm Antenna | $-19.0 + 65.0 \times W^{.55}$ | 184 | $1.5 \leq W \leq 190$ |
| Comm Electronics | $30.7 \times W$ | 2820 | $29 \leq W \leq 340$ |
| Combined Communications and TT&C | $38.7 \times W^{.9}$ | 3170 | $26 \leq W \leq 610$ |
| Attitude Control | $21.4 \times W^{.97}$ | 961 | $3 \leq W \leq 310$ |
| Electrical Power Supply | $72.4 \times (W \times P)^{.27}$ | 544 | $9 \leq W \leq 620$<br>$25 \leq P \leq 1640$ |
| AKM (1-Axis) | $14.9 \times W^{.72}$ | 44.5 | $18 \leq W \leq 120$ |
| Platform (w/o Comm) | $46.3 \times W^{.77}$ | 3040 | $56 \leq W \leq 2700$ |
| Program Level | $329 \times C$ | 1470 | $1.1 \leq C \leq 40$ |
| Dispenser | $74.0 + 0.882 \times W$ | 42.6 | $32 \leq W \leq 250$ |
| LOOS (w/o AKM) | $0.52 \times W$ | 159 | $460 \leq W \leq 3000$ |

* Base year is FY 1979.
W = subsystem weight (in lb)
P = BOL power (in watts)
C = hardware cost (in $M)

Source: Space Division SD-TR-81-45, "Unmanned Spacecraft Cost Model," fifth edition, Jun 81.

TABLE 10-11. COMPUTATION OF SATELLITE COSTS

| Category | Parameters Lb | Watts | Lb-Watts | Cost ($K) Non-Recurring | First Unit |
|---|---|---|---|---|---|
| S, TC, & I | 230 | | | $ 4,580 | $ 700 |
| Comm. & TT&C | 320 | | | 14,600 | 6,960 |
| ACS | 150 | | | 9,880 | 2,760 |
| EPS | 320 | 540 | 172,800 | 4,630 | 1,880 |
| Subtotal Platform | 1020 | | | $33,670 | $12,300 |
| | Non-Rec. Factor | | Recur. Factor | | |
| Program Level | 357 | | 329 | $12,000 | $ 4,050 |
| Subtotal Spacecraft | | | | $45,670 | $16,350 |
| Fee | 0.13 | | 0.13 | 5,940 | 2,130 |
| Total | | | | $51,610 | $18,480 |

NOTE: Base year is FY 1979.

(b) The beginning of life (BOL) output of the solar array is 540 watts. The production run will be for six satellites and a 13 percent fee is anticipated. Costs are desired in constant FY 1984 dollars. Thermal control is added to structure and interstage to obtain a total of 230 pounds for the S, TC, and I subsystem. In the absence of other data, the contingency weight is spread over the designed weights proportionally. The combined CER is used for communications and TT&C. The calculations are shown in table 10-11.

(c) Production cost for six units assuming 95-percent cumulative average learning curve = 6 x .876 = 5.256
Total Cost = Nonrecurring Cost + Production Cost
= $51,610 + (5.256 X $18,480)
= $148,700K
To convert from FY 1979 to FY 1984 dollars divide by .687 (see chapter 38).
Total cost of program in constant FY 1984 dollars = $216,400,000.

# b. Satellite Software.

(1) Cost Considerations. This paragraph presents an analytical methodology for estimating software costs. Because software cost estimating suffers from a lack of information concerning the software packages, the methodology presented here requires only an estimate of the number of source instructions.

(2) Cost Estimating Relationships (CER's). The CER's in table 10-2 are based on data obtained from space-oriented programs. They relate the number of source instructions to the number of manmonths required to complete and test the software package.

(3) Use of Table. To obtain a cost estimate using the relationships in table 10-12, first obtain an estimate of the number of source instructions required. Manmonths can be translated into dollars using either paragraph 24-1 or paragraph 24-5. Software costs should then be placed in the appropriate base year using chapter 38.

(4) Example. The resources required for a real-time software package with an anticipated 74,000 source instructions are estimated as follows:

$$29.7 \times 74 \times 1.1 = 2{,}420 \text{ manmonths}$$

TABLE 10-12. SATELLITE SOFTWARE CER'S

| Category | CER (MM)* | Standard Error | Range |
|---|---|---|---|
| Real-time | 29.7 x I | 440 | $3 \leq I \leq 325$ |
| Support | 62.6 + 2.17 x I | 23.6 | $7 \leq I \leq 92$ |

*MM = manmonths. Add 10% for documentation and management costs outside the scope of the software effort.
I = thousands of source instructions

Source: Space Division SD-TR-81-45, "Unmanned Spacecraft Cost Model," fifth edition, Jun 81.

# c. Launch Vehicles.

(1) Cost Considerations. In addition to the cost of the satellite itself, the cost of the launch vehicle must be estimated. Currently, the Space Transportation System (STS), or Space Shuttle, is used for launching communications satellites. The Shuttle carries the satellite into earth orbit and an upper stage propels it from there into synchronous orbit. The weight of the satellite payload determines which booster to use.

(2) Equipment Table. Table 10-13 shows the total costs for placing payloads in orbit. This includes reimbursement to NASA for Shuttle services, purchase of the upper stage, and upper stage launch services.

(3) Use of the Table. Determine which upper stage will be used and the launch date. The cost from table 10-13 should then be used together with the appropriate relationships from table 4-2 to calculate space segment costs.

TABLE 10-13. LAUNCH VEHICLE COSTS

| Upper Stage | Payload | STS Cost FY 87 | STS Cost FY 88 |
|---|---|---|---|
| Payload Assist Module-Delta (PAM-D) | 2,000 lb | | |
| Orbital Flight Charges (OFC) | | $ 24M | $ 26M |
| PAM | | 5 | 5 |
| Launch Services | | 1 | 1 |
| | | $ 30M | $ 32M |
| Inertial Upper Stage (IUS) | 5,000 lb | | |
| OFC | | $ 74M | $ 79M |
| IUS | | 56 | 56 |
| Launch Services | | 25 | 25 |
| | | $155M | $160M |
| Centaur | 10,000 lb | | |
| OFC | | $ 74M | $ 79M |
| Centaur | | 46 | 46 |
| Launch Services | | 16 | 16 |
| | | $136M | $141M |

NOTES: Assumes scheduled availability.
Probability of successful insertion into geosynchronous orbit is approximately 0.97

Source: AF/RDSL, Feb 84.

# d. Earth Terminals.

(1) Cost Considerations. There are large variations in the complements of equipment involved in earth terminals. However, preliminary analyses with limited data do indicate some correlation between procurement cost and earth terminal transmitter power and antenna diameter for SHF earth terminals. (UHF earth terminals are not covered, since no UHF systems are currently part of the DCS.) RDT&E costs are estimated to be approximately 10 times the unit procurement cost.

(2) Equipment Table. The cost-estimating relationship shown in table 10-13 has been derived for SHF earth terminals, based on the historical costs of 13 ground- and air-based systems.

(3) Use of the Table. To use table 10-13, estimate the antenna diameter in feet (D) and the transmitter power requirement in kW (P). Enter these into the CER to calculate cost. Actual costs taken from recent procurement, restated in FY 1980$ are: AN/TSC-86, $2.8M and AN/GSC-39, $5.2M. These higher costs should be used for a conservative estimate.

TABLE 10-14. SHF EARTH TERMINAL CER

| CER ($M) | Independent Variables |
|---|---|
| .0835 x D + .157 x P + .679 | D = Antenna Diameter in ft<br>P = Transmitter Power in kW |

NOTE: Base year is FY 1980.

Source: DCA, Code 690, Mar 79.

(4) Example. Estimate the procurement costs of two DSCS III earth terminals. Their D and P values are as follows:

| Terminal Type | D(Antenna Diameter) | P(Transmitter kW) |
|---|---|---|
| AN/TSC-86 | 20 | 1 |
| AN/GSC-39 | 40 | 5 |

AN/TSC-86: .0835(20 ft) + .157(1 kW) + .679 = $2.5M
AN/GSC 39: .0835(40 ft) + .157(5 kW) + .679 = 4.8M

6. Cable Systems Equipment. This paragraph contains tables of equipment costs for submarine cable equipment and installed land cable systems.

a. Submarine Cable Equipment.

(1) Cost Considerations. Underwater systems equipment is not a shelf item and is produced individually for each system. Therefore, care must be exercised in using any cost figures from previous system installations. Prior to engineering the cable installation, a survey ship must survey the route. For cable planning purposes, 10 percent must be added to the distance between the shore terminals to allow for deviations in the cable route and variations in ocean floor topography. The cost of the terminal equipment varies with the number of cables terminated.

(2) Equipment Table. Table 10-11 contains prices of coaxial cable, repeaters, equalizers, and terminal equipment. Costs for primary power, multiplex, military construction, etc., may be found in the appropriate chapters.

(3) Use of Tables. Estimate the approximate distance between the cableheads in nautical miles and add 10 percent. At the cableheads, the cable must be heavily armored (type LPAA or LPA-10) until deep water is reached. Where the cable is subjected to tidal currents and a rough bottom (such as coral), LPA or type A (lighter armor) cable is used. The balance of the cable may be type D. Estimate the number of repeaters required by dividing the total distance by 17 nmi for 60-channel systems or 12 nmi for 120-channel systems, then subtracting one repeater from the result. Add one equalizer for every 10 to 12 repeaters. One lot of terminal equipment is required at each shore end installation. Estimate the cable and survey ship operations by multiplying and dividing the total cable length by the appropriate factors. For example, to load 1,900 nmi of cable, divide 1,900 nmi by 1.9 knots and the result is 1,000 hours.

TABLE 10-15. SUBMARINE CABLE SYSTEMS EQUIPMENT

| Factor | Cost |
|---|---|
| Cable | |
| Type LPAA | $43,600/nmi |
| Type LPA-10 | 33,000/nmi |
| Type LPA | 27,500/nmi |
| Type A | 10,600/nmi |
| Type D | 5,700/nmi |
| Repeaters (tube-type) | |
| 60 or 120 Channels | $36,000/each |
| Equalizers (tube-type) | |
| 60 or 120 Channels | $35,400/each |
| Terminal Equipment | |
| 60-channel terminal equipment consisting of d.c. power feed equipment containing 2 rectifier bays, 1 supervisory bay, 1 cable terminating bay, and 1 terminal bay containing pads, equalizers, and regulators. | $85,000/each |
| 120-channel terminal equipment consisting of d.c. power feed equipment containing 2 rectifier bays, 1 supervisory bay, 1 cable terminating bay, and 1 terminal bay containing pads, equalizers, and regulators. | $132,000/each |
| Survey and Cable-Laying Ship Operations | $8,100/day |
| Ship Operations | |
| Survey Ship Operations | 80 nmi/day |
| Cable Loading | 1.9 nmi/hour |
| Sailing Time | 12 nmi/hour |
| Cable Laying | 2.75 nmi/hour |
| Laying Shore Ends | 12 hours/end |

TABLE 10-15. SUBMARINE CABLE SYSTEMS EQUIPMENT (CON.)

| | |
|---|---|
| Contingencies (foul weather, breaks, equipment breakdown) | 10% of total cable ship time |
| Cable Guard (long-term contract) | |
| In Port | $2,800/day |
| At Sea | 3,000/day |

Source: Cable ship operations costs based on FY 1972 contract prices; cable systems equipment costs based on FY 1968 contract prices; DCA, Code 690.

b. Land Cable Systems.

(1) Cost Considerations. Land cable systems may require a wide variety of equipment. The engineering required to provide simple block diagrams for the many configurations possible in one subsystem is beyond the scope of this manual. Some publications, such as the Rural Electrification Administration's "Report No. 30, United States Average Bid Cost for Outside Plant Assembly Units" and associated reports, may assist the engineer in detailed costing of a land cable subsystem.

(2) Equipment Table. Table 10-12 contains costs for installation of land cables. Column 1 includes the costs for cable, conduit, and concrete, and installation of all materials. Column 2 includes only the costs for the cable and cable installation. The costs for the conduit and the conduit installation are not included. Column 3 includes the cable, wood poles, crossarms, guys, etc., and installation of all materials.

TABLE 10-16. INSTALLED TELEPHONE CABLE COSTS

| Number Of Pairs | Cost Per Linear Foot: Underground In Concrete-Encased Conduit (1) | Underground Cable For Conduit Installations (2) | Cable Elevated On Wood Poles (3) |
|---|---|---|---|
| 6 | $13.53 | $ 1.05 | $1.29 |
| 11 | 13.91 | 1.21 | 1.50 |
| 26 | 14.39 | - | 1.84 |
| 51 | 15.72 | 1.80 | 2.22 |
| 76 | 16.85 | 2.11 | 2.60 |
| 101 | 17.87 | 5.03 | 3.30 |
| 202 | 21.94 | 8.85 | 4.79 |
| 303 | 25.16 | 11.87 | 6.24 |
| 404 | 28.38 | 15.10 | - |

Source: NAVFAC DM-10, Jun 71.

TABLE 11-4. FDM EQUIPMENT, RACK COSTS (CON.)

| Item | Cost |
|---|---|
| 3. Channel MODEM Multiplexer Group OB-31(V)/UCC-4(V): | |
| Basic rack equipped for 12 VF channels | $ 11,900 |
| Each additional 12 VF channels (maximum 60 per rack) | 4,300 |
| Channel Carrier Amplifiers (pair) for even-numbered racks after first rack | 3,200 |
| a.c. Power Supply Unit (one per rack)[2] | 2,500 |
| 4. Equalizer Group, Envelope Delay OA-8370(V)/UCC-4(V): (Delay Equalizer Rack) | |
| Basic rack equipped for 12 VF channels | 5,300 |
| Each additional 12 VF channels (maximum 150 per rack) | 1,800 |
| 5. Amplifier/Pilot Regulator Group OA-8367(V)/UCC-4(V): (Group Regulator Rack) | |
| Basic rack equipped with one group regulator | 6,000 |
| Each additional group regulator (maximum 15 per rack) | 1,000 |
| a.c. Power Supply Units[2] (One unit for 1 to 5 regulators) (Two units for 6 to 10 regulators) (Three units for 11 to 15 regulators) | 2,500 |
| 6. Multiplexer Group OB-29(V)/UCC-4(V):[3] (Supergroup-Group Multiplexer Rack) | |
| Basic rack equipped for 1 supergroup and 5 groups | 9,000 |
| Each additional supergroup and 5 groups (maximum 10 SG, 50 groups per rack) | 1,900 |

[2]See footnote 2, page 11-10.
[3]See footnote 3, page 11-10.

TABLE 11-4. FDM EQUIPMENT, RACK COSTS (CON.)

| Item | Cost |
|---|---|
| 7. Demultiplexer Group OB-30(V)/UCC-4(V):[3] (Supergroup-Group Demultiplexer Rack) | |
| Basic rack equipped for 1 supergroup and 5 groups | $13,100 |
| Each additional supergroup and 5 groups (maximum 10 SG, 50 groups per rack) | 2,600 |
| 8. Interconnecting Group ON-82(V)/UCC-4(V): (Supergroup-Group Interconnecting Rack) | |
| Basic rack equipped for one supergroup interconnection (two interconnect units) | 4,600 |
| One additional supergroup interconnection (two interconnect units) (maximum 4 units per rack) | 2,600 |
| Each group interconnection (two group interconnect units) (maximum 10 units per rack) | 900 |
| 9. Interconnecting Group ON-89(V)/UCC-4(V): (Group Interconnecting Rack) | |
| Basic rack equipped for one group interconnection (2 Group interconnect units) | 1,700 |
| Each additional group interconnection (two group interconnect units) (maximum 14 units per rack) | 900 |
| 10. Test Set, Telephone, AN/UCM-1: (Transmission Test Set) | 4,200 |

[3]See footnote 3, page 11-10.

Source: AN/UCC-4(V) Contract Order Requirements for FY 1972; DCA, Code 690.

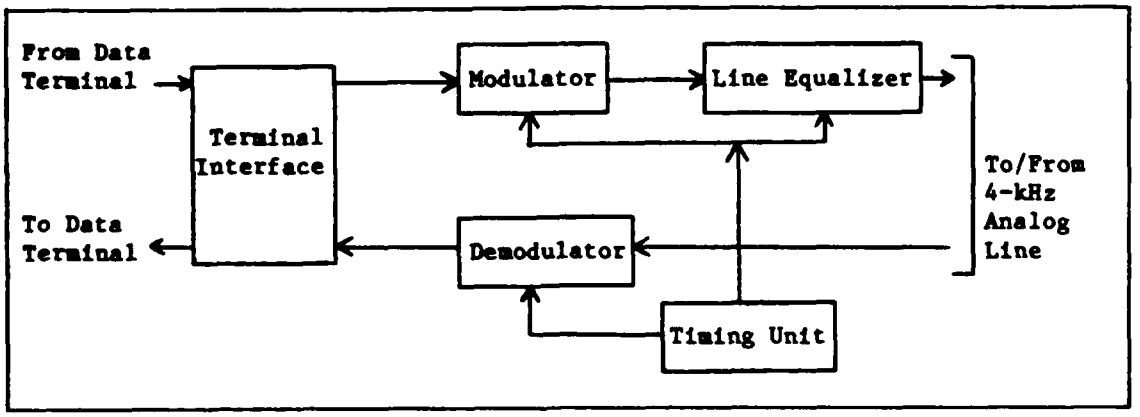



FIGURE 14-1. MODEM BLOCK DIAGRAM

(3) Line equalizers (either fixed, manual, or automatic) are provided within the modem to improve transmission quality by compensating for any distortions (in particular, intersymbol interference) on the transmission line. The type of equalization incorporated depends upon the modem's application and transmission rate. A fixed compromise equalizer, the simplest of the three equalizer types, is incorporated within modems operating up to 2000 b/s. Medium-speed modems normally contain equalizers that can be normally adjusted to variations in the channel measured at some point in time. They are most frequently used on conditioned circuits. Automative adaptive equalizers are used in high-speed modems and are continually adjusted to compensate for channel variations.

(4) In synchronous transmissions, timing information is transmitted in addition to symbol information. The timing information recovered at the demodulator is used by the modem and the data terminal to properly sample the demodulated signal at the center of the symbol and to correctly interpret the received symbol, respectively.

(5) The external interfacing device at the modem/terminal I/O ports is either a commercial Electronic Industries Association (EIA) RS-232B/C or military MIL-STD-188-100 interconnecting cable. These 25-pin cables are serial interface standards and are used for data throughout rates up to 20 kb/s.

c. In many applications, modems are stand-alone devices and are not integral parts of the terminal; therefore, separate CER's have been developed for them. Modems are divided into two subclasses: acoustic couplers and data sets.

(1) Acoustic Coupler Modem. Acoustic couplers are low-speed transmission modems. Their nominal transmission rates range from 300 to 600 b/s; a few are capable of operating at 1200 b/s. They employ fixed compromise equalizers and use FSK modulation techniques. The interface between the modem and the voicegrade line is acoustic or inductive.

(2) Data Set Modems. Data sets are modems that have a hardwired, rather than an acoustic, interface to the telephone system. When operating over the public telephone system, this connection is accomplished via the Bell System's Data Access Arrangement (DAA). These modems operate over a transmission rate range of 300 to 9600 b/s (the maximum capacity rating of a 4-kHz line); the rates are often switch-selectable. Many modems are capable of both asynchronous and synchronous operation; synchronous transmission is provided on modems operating at transmission speeds of 1200 b/s and above. They are designed to operate in three modes: simplex, and half- and full-duplex. As with acoustic couplers, the modulation technique used in low-speed (300 to 1200 b/s) data sets is FSK. However, various types of modulation are employeed in the medium- to high-speed (2400 to 9600 b/s) range. The more commonly used techniques include variations of PSK and AM.

d. Use of Table. Table 14-6 contains a parametric cost-estimating relationship and costs for modems as described in this chapter. Solving the equations or reading directly from table 14-6 will result in costs expressed in the constant dollars of the year shown. The costs provided are averages. Standalone modems cost more than rack-mounted units. Features such as auto-answer, auto-dial, and remote loopback drive costs up. A factor is provided to convert costs to those that could be expected if the item were to be militarized. To convert to program year dollars, see chapter 38 for instructions.

5. Voice Terminals. Voice terminals convert analog speech signals into digital signals, primarily for secure speech application. However, in the all-digital DCS of the late 1980's, nonsecure digital voice capability will also be provided at the user level.

a. General. Voice terminals are classified as NB, WB, and transitional. NB voice terminals operate at 9.6 bk/s or less over narrowband, 4-kHz analog facilities. WB voice terminals operate over a transmission media with a bandwidth greater than a 4-kHz, including pairs of voicegrade lines, 48-kHz FDM analog channels, and digital lines. WB voice terminals operate at bit rates greater than 9.6 kb/s - typically, 16 to 64 kb/s. Transitional voice terminals may operate over either NB or WB facilities. The above distinction assumes that 9.6 kb/s is the maximum bit rate achievable over voicegrade lines. Capability to operate at higher rates (for example, 16 kb/s) would modify the above distinction.

#

TABLE 14-6. MODEM COSTS

| CER | Range | Militarization Factor |
|---|---|---|
| 174 + 543 x R (synchronous) | 1.2 ≤ R ≤ 9.6 | 1.9 |

| | Cost | | |
|---|---|---|---|
| R | Synchronous | Asynchronous | Telephone Couplers |
| 0.3 | | $ 380 | $ 230 |
| 0.45 | | | 260 |
| 1.2 | $ 810 | 560 | |
| 1.8 | | 480 | |
| 2.4 | 1,290 | | |
| 4.8 | 3,100 | | |
| 9.6 | 5,280 | | |

NOTES: Base year is FY 1983.
R = transmission rate in kb/sec.

Source: 1983 price lists; DCA, Code 690, Apr 84

b. Composition. As shown in figure 14-2, a voice terminal is composed of three distinct elements: a signal processor, a COMSEC module, and a line interface.

c. Signal Processor.

(1) The signal processor is composed of two main elements: a voice processor and a signaling and control module. The voice processor converts analog speech to a digital signal and vice versa. Voice processors may also remove redundancy from the speech signal to lower the bit rate required for high-quality speech. The signaling and control module sends and receives the required signaling/supervisory information and coordinates or controls the operations of the other modules. The signal processor also provides a user interface via the handset, keypad, and various controls.

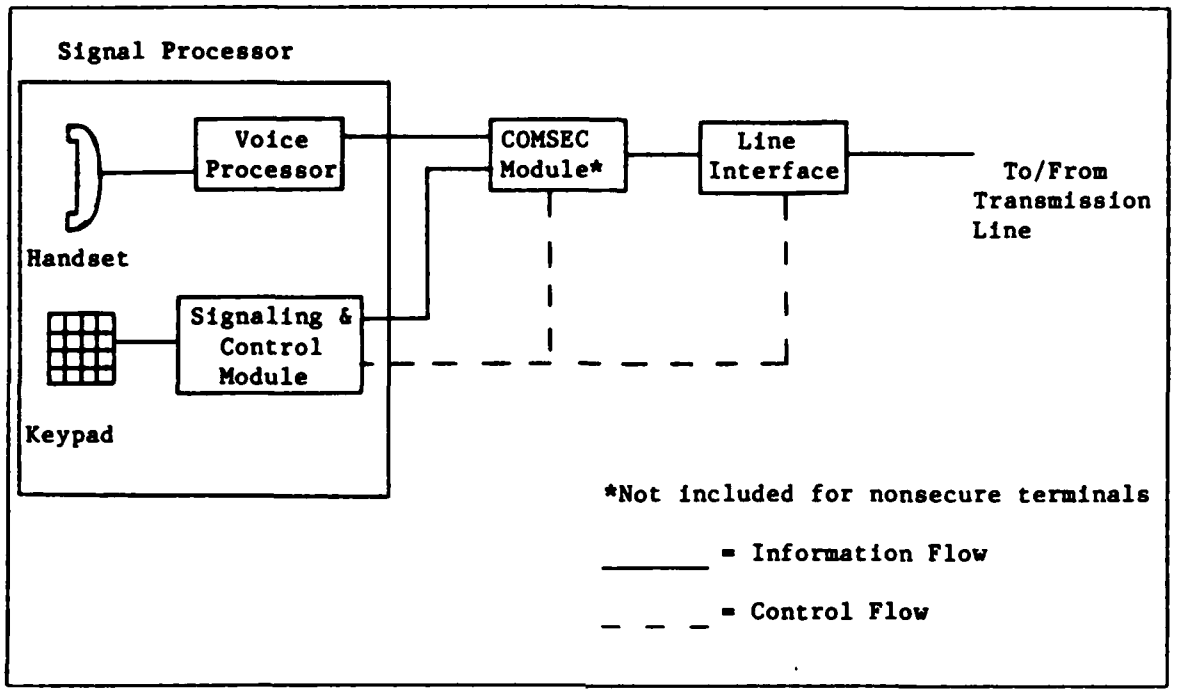



FIGURE 14-2. VOICE TERMINAL BLOCK DIAGRAM

(2) All signal processors addressed in this chapter have a similar structure. They are characterized by the type of voice processor used. NB voice terminals include the following voice processing types; linear predictive coders (LPC); adaptive predictive coders (APC); and channel vocoders (CV). One voice processor type is identified as transitional: adaptive residual coders (ARC). Wideband voice terminals include pulse code modulation (PCM) and continuously variable slope delta modulation (CVSD) voice processor types. The circuits used for signaling and control are similar and the cost of implementing these circuits has been added to the cost of the voice processor in each case to arrive at the total cost of the signal processor.

# CHAPTER 16. CONTRACTOR TRAINING

## 1. General.

a. Contractor training refers to the training services used to facilitate instruction through which personnel acquire sufficient concepts, skills, and aptitudes to operate and maintain the system with maximum efficiency. It includes those efforts associated with the design and production of training equipment and course preparation as well as the execution of training services. Costs for the development and acquisition of training equipment are an integral portion of this element and may, for certain programs, constitute the bulk of the cost for the element. Costs of training equipment setup and # support, such as Government-furnished facilities, base support, and TDY for students, are excluded from contractor training course costs.

b. Contractor training of DCS personnel may be required for new and modified DCS equipment entering the inventory. Training on existing equipment (recurring proficiency training) is provided on a recurring basis by the military departments and is treated as an operating cost. Training costs for formal courses taught in military service schools are estimated in accordance with the military departments' publications referenced as source information for table 26-4.

c. On-the-job training at any time during the system or project life is an operational function not separately identified and costed in a system or program cost estimate.

d. Those students designated to attend contractor-conducted classes will be qualified at the journeyman level in their speciality.

## 2. Derivation of Factors.

a. Costs for contractor-supplied training courses were developed to allow one instructor for classroom training and a second instructor to provide hands-on training, with a minimum of two instructors for fewer than 11 students.

b. Training costs are separated to indicate course preparation cost and cost associated with the instruction. Costs are based upon previous experience updated to the fiscal year indicated by the table source.

(1) The dollars indicated for course preparation include costs for training aids, training documentation, instructor preparation and training, material, and reproduction of technical data. Contractor technical data utilized to develop the course material are purchased through initial procurement action, as described in chapter 20, in the form of preliminary technical orders which may be obtained in advance of the formal technical documentation.

(2) Instructor costs are based upon personnel pay, per diem, continental U.S. transportation, and miscellaneous expense associated with preparation of classrooms and removal of instructional material, but not upon the communications equipment utilized for hands-on training.

3. Use of Tables. Table 16-1 presents data for estimating contractor cost for course preparation and instruction to be provided on a military facility for use when specific data applicable to the particular training program are not available. Table 16-2 provides a planning factor for use when class # duration and the number of students is not known.

4. Estimating Procedure.

a. Review the equipment specifications and other available information, including prior training requirements or related equipment. Then estimate the number of personnel to be trained, the number of weeks each trainee requires for training, and the maximum number of students per class who can be trained on available equipment.

b. Using table 16-1, select the appropriate course preparation costs for the number of weeks each course is to be conducted. This is a single cost which does not increase for additional classes covering the same course material.

c. Determine the number of times the course must be repeated by dividing the number of students to be trained by the number of students who can be taught in each class. The limiting factors are the hours of hands-on training required by each student, the training hours available for the equipment, and the complexity of the classroom training to be provided as related to hands-on training. For example, where hands-on training requirements are equal to classroom training, and the equipment will accommodate only 5 students during available equipment hours, the maximum students per class should be 10. When classroom training requires twice the time for hands-on training, the class size would be 3 times the number who could receive hands-on training; or, when 5 students could receive hands-on training, the total number of students would be 15.

d. Again referring to table 16-1, select the appropriate instructor cost for the number of students in each class as determined by the course length in weeks. Multiply this cost by the number of times the course must be repeated; then add this total to the one-time charge for the course preparation cost.

e. Examples:

(1) Estimate the cost of a 3-week course to train 15 students.

| | |
|---|---|
| Course Preparation Cost | $33,000 |
| Instructor Cost | 23,000 |
| Total | $56,000 |

(2) Estimate the cost of a 3-week course to train 2 consecutive classes of 15 students each.

| | |
|---|---|
| Course Preparation Cost | $33,000 |
| Instructor Cost (2 X $23,000) | 46,000 |
| Total | $79,000 |

(3) Estimate the cost of a 6-week course to train 4 consecutive classes of 22 students each.

| | |
|---|---|
| Course Preparation Cost | $ 54,000 |
| Instructor Cost (4 X $70,000) | 280,000 |
| Total | $334,000 |

#

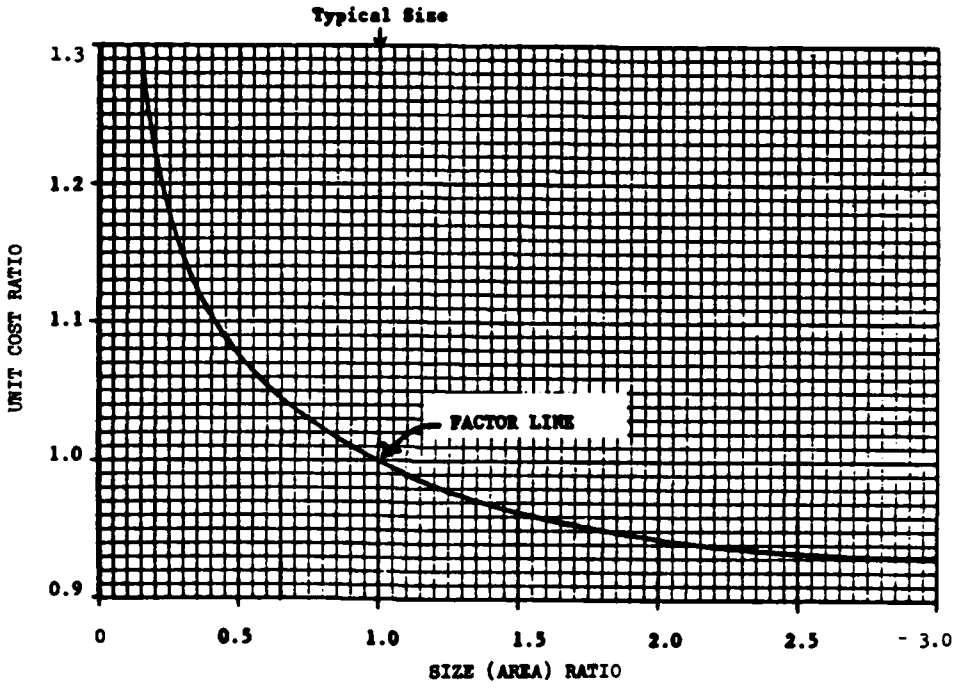
TABLE 16-1. CONTRACTOR TRAINING COURSES

| Course Length (Weeks) | Course Preparation Cost | Instructor Cost Per Number of Students in Each Class | | | |
|---|---|---|---|---|---|
| | | 10 or fewer | 11-15 | 16-20 | 21-25 |
| 1 | $13 | $ 7 | $10 | $13 | $16 |
| 2 | 23 | 11 | 16 | 22 | 27 |
| 3 | 33 | 15 | 23 | 31 | 39 |
| 4 | 40 | 19 | 30 | 40 | 50 |
| 5 | 47 | 23 | 36 | 48 | 60 |
| 6 | 54 | 27 | 42 | 56 | 70 |

Note: Costs are expressed in thousands of FY 1976 dollars. Excludes training equipment.

Source: Contractor Cost Data; DCA, Code 690.

| TABLE 16-2. CONTRACTOR TRAINING |
| --- |
| 4% x Prime Mission Equipment Acquisition Cost |
| Source: "Operating and Support Costs for Communications Systems," Sep 81, IDA Report P-1599. |




Adjust the unit cost of the proposed building for size by dividing the gross area by the typical size as shown in table 21-4; locate the quotient on the Size Ratio scale and trace vertically to the Factor Line, then trace horizontally to the Unit Cost Ratio scale. Alternatively, this scaling factor may be calculated using the equation:

$$UC = 6/7 + 1/(7 \times S^{\cdot 6}), \text{ with } S = \text{size ratio.}$$

The resultant value is then multiplied by the unit cost in table 21-4 to determine the unit cost for the proposed building.

FIGURE 21-1. SIZE/UNIT COST ADJUSTMENT CHART

# 4. Assembly, Installation, and Checkout On Site.

a. General. The element comprising assembly, installation, and checkout at the site encompasses all materials and services required for assembly and installation of mission equipment in the operations and support facility, and complete checkout of the equipment to ensure its achievement of operational status.

b. Estimating Procedure.

(1) The assembly, installation, and checkout of equipment on site may be estimated as a percentage of the total acquisition cost of the prime mission and auxiliary equipment. This factor is shown in table 21-5. Actual costs will vary by type of equipment, where the equipment is being assembled (vendor's plant or on site), and location of the site (CONUS or overseas, easily accessible or hazardous).

(2) Sufficient data to develop a more specific estimating procedure for this element are not currently available. As additional data are collected, procedures will be developed to update and expand the factor shown.

| TABLE 21-5. ASSEMBLY, INSTALLATION, AND CHECKOUT |
|---|
| 20% X Prime Mission and Auxiliary Equipment Acquisition Cost |
| Source: DCA, Code 690. |

# CHAPTER 22. INITIAL SPARES AND REPAIR PARTS

1. General. The initial spares and repair parts covered in this chapter are a part of the initial equipment procurement, and include modules, spare components, and assemblies used for replacement purposes in major end items of equipment. Initial spares and repair parts are in addition to and are separately costed from parts procured annually to replace the initial spares or repair parts. The annual purchase of recurring spares and repair parts is covered in chapter 25 for recurring investment replacement spares and chapter 24 for expense-type (supplies and equipment) spare parts.

2. Derivation of Factors. Cost-estimating factors are based on contract data accumulated during prior fiscal years. Factors are stated as percentages to be applied to the total cost of equipment. Separate factors were derived for different types of equipment.

3. Use of Table. Review the system or project equipment specifications and estimate the total cost for the equipment in each category in the table. Apply the appropriate percentages in the table to the costs for each category.

TABLE 22-1. INITIAL SPARES AND REPAIR PARTS

| Type of Equipment | Percent of Prime Mission Equipment |
|---|---|
| Radios | 35 % |
| Multiplex | 25 |
| Satellite Terminals | 20 |
| Modems | 20 |
| Antennas | 10 |
| Computers | 8 |
| Other Communications | 20 |

Source: "Operating and Support Costs for Communications Systems," Sep 81, IDA Paper P-1599.

# TABLE 23-1. MILITARY PERSONNEL STANDARD RATES

| RANK | ARMY | NAVY | MARINE CORPS | AIR FORCE | DOS COMPOSITE |
|---|---|---|---|---|---|
| O-10 | $76050 | $77783 | $76902 | $77124 | |
| O-9 | 77979 | 80205 | 79112 | 75907 | |
| O-8 | 76865 | 83470 | 77662 | 75566 | |
| O-7 | 70024 | 70446 | 70612 | 68359 | |
| O-6 | 64285 | 66604 | 62682 | 62283 | $64166 |
| O-5 | 53935 | 55544 | 53518 | 53552 | 54086 |
| O-4 | 45443 | 47040 | 44922 | 46633 | 45945 |
| O-3 | 36475 | 39994 | 39137 | 38723 | 37535 |
| O-2 | 28988 | 30883 | 32306 | 29825 | 29494 |
| O-1 | 22739 | 25140 | 23445 | 23300 | 23232 |
| W-4 | 41305 | 45111 | 42876 | | 42066 |
| W-3 | 34552 | 37556 | 34261 | | 35153 |
| W-2 | 29471 | 33170 | 30450 | | 30212 |
| W-1 | 25705 | | 26496 | | 25705 |
| E-9 | 35454 | 37557 | 37455 | 36127 | 35759 |
| E-8 | 29741 | 32308 | 31208 | 30771 | 30230 |
| E-7 | 25100 | 27948 | 26124 | 26654 | 25776 |
| E-6 | 21369 | 23368 | 21861 | 23055 | 22037 |
| E-5 | 18272 | 19236 | 18805 | 19554 | 18746 |
| E-4 | 15894 | 16233 | 15740 | 16779 | 16202 |
| E-3 | 13830 | 13657 | 13126 | 14367 | 13954 |
| E-2 | 12625 | 12369 | 11952 | 12934 | 12710 |
| E-1 | 11610 | 11064 | 10785 | 11696 | 11605 |

NOTES: FY 1984 RATES; BASIC PAY LIMITED TO $66,000 FOR O-9 AND O-10; ALL RATES INCLUDE PCS.

SOURCE: MILITARY DEPARTMENT BUDGET OFFICES; DCA CODE 690, MAY 84.

TABLE 23-2. DCA MILITARY LABOR RATES

| | ANNUAL RATES | | HOURLY RATES | | |
|---|---|---|---|---|---|
| | | | | REIMBURS-MNTS FROM ORGNIZTNS OUTSIDE FED GOVT | REIMBURS-MNTS FROM FEDERAL AGENCIES |
| RANK | PROGRAM, BUDGET, ACCNTNG (1) | ECONOMIC ANALYSIS (2) | REPORTS (3) | (4) | (5) |
| O-6 | $64166 | $90950 | | | |
| O-5 | 54086 | 78199 | $48.52 | $41.27 | $33.14 |
| O-4 | 45945 | 67900 | 41.22 | 35.06 | 28.15 |
| O-3 | 37535 | 57262 | 33.67 | 28.64 | 23.00 |
| O-2 | 29494 | 47050 | 26.46 | 22.50 | 18.07 |
| O-1 | 23232 | 39168 | 20.84 | 17.73 | 14.23 |
| W-4 | 42066 | 62954 | 37.74 | 32.10 | 25.77 |
| W-3 | 35153 | 54249 | 31.53 | 26.82 | 21.54 |
| W-2 | 30212 | 47998 | 27.10 | 23.05 | 18.51 |
| W-1 | 25705 | 42297 | 23.06 | 19.61 | 15.75 |
| E-9 | 35799 | 55066 | 32.11 | 30.36 | 24.98 |
| E-8 | 30230 | 48021 | 27.12 | 25.64 | 21.09 |
| E-7 | 25776 | 42387 | 23.12 | 21.86 | 17.99 |
| E-6 | 22037 | 37657 | 19.77 | 18.69 | 15.38 |
| E-5 | 18746 | 33494 | 16.82 | 15.90 | 13.08 |
| E-4 | 16202 | 30276 | 14.53 | 13.74 | 11.31 |
| E-3 | 13994 | 27482 | 12.55 | 11.87 | 9.76 |
| E-2 | 12710 | 25858 | 11.40 | 10.78 | 8.87 |
| E-1 | 11605 | 24460 | 10.41 | 9.84 | 8.10 |

NOTE: FY 1984 RATES.

SOURCE: TABLE 23-1; DCA CODE 690, MAY 84.

# TABLE 23-3. DCA MILITARY LABOR RATES - MAJOR

| | ANNUAL RATES | | HOURLY RATES | | |
|---|---|---|---|---|---|
| | | | | REIMBURS-MNTS FROM ORGNIZTNS | REIMBURS-MNTS FROM |
| | PROGRAM, BUDGET, ACCNTNG | ECONOMIC ANALYSIS | REPORTS | OUTSIDE FED GOVT | FEDERAL AGENCIES |
| COST ELEMENT | (1) | (2) | (3) | (4) | (5) |
| STANDRD RATE | $ 45945 | $ 45945 | $ 45945 | $ 45945 | $ 45945 |
| RETIREMENT | | 12175 | 12175 | 12175 | |
| HOSPITAL | | 520 | | | |
| BASE OPNS | | 2230 | | | |
| TRAINING | | 5790 | | | |
| TDY | | 1240 | | | |
| OTHER PERS | | | | 3676 | 3676 |
| OVERHEAD | | | 14530 | | |
| LV/HOLIDAY | | | 13077 | 11123 | 8532 |
| ANNUAL RATE | $ 45945 | $ 67500 | | | |
| HOURLY RATE | | | $ 41.22 | $ 35.06 | $ 28.15 |

NOTE: FY 1984 RATES.

SOURCE: DCA CODE 690, MAY 84.

Government and non-Government); such as those in tables 24-1 and 24-2, include leave and holiday costs. When the estimated amount of labor includes time for leave and holidays; e.g., when an annual approach is used, the leave and holiday accrual factor should not be included.

(g) The references for column 3 are DoDI 5000.22, Guide to Estimating Costs of Information Requirements, 17 October 1974, and DCAI 630-225-2, Management and Control of Information Requirements, 4 October 1976, as amended.

(h) The reference for columns 4 and 5 is OASD(C) Memorandum, subject: Reimbursement Rates for Personnel Services, 24 September 1980.

TABLE 24-1. DCA CIVILIAN LABOR RATES

| | ANNUAL RATES | | HOURLY RATES | | |
|---|---|---|---|---|---|
| | PROGRAM, BUDGET, ACCTNG | ECONOMIC ANALYSIS | REPORTS | REIMBRS-MNTS FROM ORGNIZTNS OUTSIDE FED GOVT | REIMBURS-MTS FROM FEDERAL AGENCIES |
| GRADE: | (1) | (2) | (3) | (4) | (5) |
| SES | $ 75230 | $ 85878 | | | |
| 15 | 64902 | 74320 | $ 51.46 | $ 41.17 | $ 36.82 |
| 14 | 55246 | 63516 | 43.80 | 35.04 | 31.34 |
| 13 | 46823 | 54089 | 37.12 | 29.69 | 26.56 |
| 12 | 39433 | 45822 | 31.25 | 25.00 | 22.37 |
| 11 | 32904 | 38525 | 26.08 | 20.86 | 18.67 |
| 10 | 29945 | 35218 | 23.73 | 18.99 | 16.99 |
| 9 | 27192 | 32141 | 21.55 | 17.24 | 15.43 |
| 8 | 24622 | 29268 | 19.51 | 15.61 | 13.97 |
| 7 | 22229 | 26594 | 17.62 | 14.09 | 12.61 |
| 6 | 20006 | 24110 | 15.86 | 12.68 | 11.35 |
| 5 | 17944 | 21805 | 14.22 | 11.38 | 10.18 |
| 4 | 16040 | 19678 | 12.71 | 10.17 | 9.10 |
| 3 | 14290 | 17721 | 11.33 | 9.06 | 8.11 |
| 2 | 12675 | 15917 | 10.05 | 8.04 | 7.19 |
| 1 | 11644 | 14764 | 9.23 | 7.38 | 6.61 |

NOTE: FY 1984 RATES; SES CALCULATED AT $ 66400.

SOURCE: DCA, CODE 690, MAY 84.

TABLE 24-2. DCA CIVILIAN LABOR RATES - GS 13

| | ANNUAL RATES | | HOURLY RATES | | |
|---|---|---|---|---|---|
| | PROGRAM, BUDGET, ACCNTNG | ECONOMIC ANALYSIS | REPORTS | REIMBURS-MNTS FROM OUTSIDE FED GOVT | REIMBURS-MNTS FROM FEDERAL AGENCIES |
| COST ELEMENT: | (1) | (2) | (3) | (4) | (5) |
| PAYROLL RATE: | $ 41171 | $ 41171 | $ 41171 | $ 41171 | $ 41171 |
| BENEFITS | 5652 | 5652 | 5652 | 5652 | 5652 |
| FLLL RET INC | | 5517 | 5517 | 5517 | |
| TRAINING | | 510 | | | |
| TDY | | 1240 | | | |
| OVERHEAD | | | 13084 | | |
| LV/HOLIDAY | | | 11776 | 9421 | 8428 |
| ANNUAL RATE | $ 46823 | $ 54090 | | | |
| HOURLY RATE | | | $ 37.12 | $ 29.69 | $ 26.56 |

NOTES : FY 1984 RATES. SEE PARAGRAPH 1.A.(4)(D) FOR COSTS THAT ARE POTENTIALLY ADDITIVE FOR ECONOMIC ANALYSES.

SOURCE: DCA, CODE 690, MAY 84.

(4) Use of Table 24-1.

(a) This table presents a compilation of civilian personnel rates for most applications.

(b) When the grade is known, locate the grade level on the table and select the appropriate subheading for the type of study being conducted. When the specific grade is unknown, see table 24-3 for examples of specific occupational series. Alternatively, use GS-9 for systems studies as an estimate of station or site operations personnel, and use GS-13 for Headquarters, DCA, and field activities personnel.

(c) Column 1 is used for programing, budgeting, and accounting.

(d) Column 2 is used for cost analyses, economic analyses, and program evaluations done under OMB Circular A-94, DoDI 7041.3, or DCAI 600-60-1. If appropriate, costs should be added for civilian differential allowances (table 24-4), civilian hazardous duty allowances (figure 24-2), permanent change of station (table 24-7), and for education of dependent children overseas (table 26-2). The following, while not normally included in an economic analysis, should be added if appropriate to the specific analysis being conducted: prorated costs for rent, building maintenance, utilities, supplies, transportation, and contractual services.

(e) Column 3 is used for reports covered by DCAI 630-225-2. The term "report" refers to data, information, or reports which carry out specified and authorized Government functions. Column 3 is not used for Freedom of Information Act (FOIA) requests, which always involve a requestor outside the Government, and fees which cover direct costs only (see chapter 42 for FOIA fees, and for a more complete discussion of report cost estimating).

(f) Column 4 gives an hourly rate to calculate reimbursements from organizations outside the Federal Government, and column 5 gives an hourly rate to calculate reimbursements from Federal agencies.

(g) Columns 3, 4, and 5 (hourly rates) are to be used when the estimated amount of labor is based on time actually worked; i.e., when the reimbursing activity does not otherwise pay for the personnel costs incurred by DoD during leave and holiday periods. When the amount of labor estimated includes time or leave and holidays; e.g., when an annual approach is used, then the rates in columns 3, 4, or 5 should be adjusted to eliminate leave and holiday costs (by dividing by 1.18), and to express the result on an annual basis (by multiplying by 2080). An annual rate derived in this way may be divided by four to determine a quarterly rate or by twelve to determine a monthly rate.

(5) Table 24-2. This table gives an example of the calculations used in this paragraph, using the grade of GS-13, step 5.

b. Median Grades for Federal White-Collar Workers.

(1) General. In the absence of a specific grade structure, table 24-3 provides assistance in determining the median grade for a given occupation. While not all inclusive, this table contains median grades for occupations most often associated with communications. For median grades in occupations not included in this table, contact the Director, DCA, ATTN: Code 690.

(2) Use of Table. The data shown in this table are grouped by types of occupations and listed by occupational category and series. The median grade for each occupation can be found by reading across the table.

TABLE 24-3. MEDIAN GRADES FOR FEDERAL WHITE-COLLAR WORKERS

| Occupational Category & Series | Median Grade |
|---|---|
| **Data Processing** | |
| Computer Specialist, 334 | 12 |
| Computer Systems Operator, 332 | 7 |
| Electronic Accounting Machine Project Planner, 362 | 7 |
| Computer Aide and Technician, 335 | 5 |
| Electronic Accounting Machine Operator, 359 | 4 |
| Coding Clerk, 357 | 4 |
| **Communications-Electronics** | |
| Engineer, Electronics, 855 | 12 |
| Communications Specialist, 393 | 11 |
| Electronics Technician, 856 | 11 |
| Communications Manager, 391 | 11 |
| Communications Relay Equipment Operator, 390 | 7 |
| General Communications Clerk, 392 | 6 |
| Cryptographic Equipment Operator, 388 | 6 |
| Radio Operator, 389 | 4 |
| Teletypist, 385 | 4 |
| Communications Clerk, 394 | 4 |
| Telephone Operator, 382 | 3 |

# TABLE 24-6. TEMPORARY DUTY TRAVEL COSTS

| | CONUS | Overseas |
|---|---|---|
| POV Mileage (Driver only) | $0.205/mi | - |
| Car Rental (Compact) | $22-27/day | $40/day |
| Per Diem* | | |
| Major Cities | $56-75/day | $50-130/day |
| Other | $35/day | $50/day |
| Miscellaneous Expenses | $20/round trip | $50/round trip |

| Air Fare from or to Washington, D.C. | |
|---|---|
| MAC travel to Europe | $400 |
| Commercial Air (Category Z) | |
| Africa | 780 |
| Alaska | 300 |
| Caribbean | 155 |
| CONUS cities | 29-279 |
| Europe | 415 |
| Far East | 830 |
| Hawaii | 300 |
| Near East | 590 |
| United Kingdom/Belgium | 345 |

*Reimbursement is reduced 50 percent when Government quarters are available and 14 percent when Government mess is available and increased by the amount of charges.

Source: DCA Travel Office, May 84; USAF MAC Airlift Service Industrial Fund Rates, 28 Jul 83; DCA Code 690.

TABLE 24-11. OCEAN FREIGHT RATES

| | General Cargo | Military Vans | Wheeled Vehicles |
|---|---|---|---|
| East Coast to: | | | |
| Panama Lant | $ 67 | $42 | $46 |
| Europe | 81 | 52 | 56 |
| British Isles | 79 | 51 | 55 |
| East Mediterranean | 88 | 58 | 62 |
| South & East Africa | 97 | 65 | 69 |
| West Coast, S. America | 78 | 50 | 54 |
| East Coast, S. America | 87 | 57 | 61 |
| Rhine River | 82 | 53 | 57 |
| West Coast to: | | | |
| Panama Lant | 86 | 51 | 57 |
| Europe | 108 | 68 | 74 |
| British Isles | 107 | 67 | 73 |
| East Alaska | 73 | 41 | 48 |
| West Alaska | 77 | 45 | 51 |
| Hawaiian Islands | 80 | 45 | 51 |
| Taiwan | 98 | 60 | 67 |
| Philippine Islands | 102 | 63 | 69 |
| Thailand | 108 | 67 | 74 |
| South Pacific | 89 | 53 | 60 |
| West Coast, S. America | 91 | 55 | 61 |
| East Coast, S. America | 106 | 66 | 73 |
| Vietnam | 112 | 71 | 77 |
| Ryuku Islands | 98 | 60 | 67 |
| Korea | 96 | 59 | 65 |
| Japan | 95 | 58 | 64 |

NOTES: These measurement-ton rates include transportation, port handling, and documentation cost for containers already packed. If sea vans are stuffed (packed) at port, add $18.88 per ton at east coast or $11.00 per ton at west coast.

Source: Military Sealift Command Billing Rates, COMSCINST 7600.3F, dated 15 July 75; MTMC Port Handling Billing Rates, DA Pamphlet 55-3, dated Sep 78; DCA, Code 690, as of 4 Nov 75.

(4) Table 24-12, Vehicle Operating and Maintenance Costs. An estimate of the average annual operating and maintenance costs (except for costs of the vehicle operator) of Government-owned and Government-operated vehicles can be obtained from the following table by multiplying the number of vehicles by the estimated mileage (or average mileage) for each vehicle of a similar type, then multiplying this product by the appropriate O&M cost.

# TABLE 24-12. VEHICLE OPERATING AND MAINTENANCE COSTS

| Type of Vehicle | Average Annual Mileage Per Vehicle | Average Miles Per Gallon of Fuel | Total O&M Cost Per Mile* (CONUS) |
|---|---|---|---|
| Sedan | | | |
| Compact | 8,400 mi | 18.6 mpg | $0.24 |
| Standard | 6,800 | 15.0 | .34 |
| Station Wagon | | | |
| Compact | 10,500 | 17.4 | .24 |
| Open Road | 8,700 | 20.2 | .24 |
| Ambulance | 3,700 | 9.7 | .60 |
| Bus | 11,300 | 7.8 | .62 |
| Truck | | | |
| Compact | 9,700 | 18.3 | .18 |
| Up to 4.25 Tons | | | |
| 4 X 2 | 9,600 | 10.7 | .38 |
| 4 X 4 | 10,200 | 10.0 | .42 |
| 6.25-12 Tons | 5,700 | 10.0 | .45 |
| Over 12 Tons | 6,300 | 7.7 | .61 |

NOTES: Base Year is FY 1984.
*Excludes vehicle operator salary.

Source: AFR 173-13, table 2-8, 1 February 1984.

4. Utilities and POL.

a. General. The annual recurring costs of petroleum, oils, and lubricants (POL), heat, light, and other related utility services, except transportation and communications services (post, camp, or station communications), are discussed herein.

(1) The cost for operating well pumps for onsite water and sewage systems, except for personnel cost, is contained in the cost factors for electricity, POL (fuel) supplies, and miscellaneous costs.

(2) The use of POL products is addressed in terms of operating power units for generators and necessary heating of buildings. Vehicle fuel requirements are addressed in paragraph 3.

(4) Example 2. An LOS microwave site without commercial power requires a class A power plant consisting of three 30-kW generators (prime, backup, and scheduled maintenance) plus an auxiliary class D static system to ensure uninterruptible power. The average load is 25 kW. Factors appear in table 24-13.

# Annual utilities cost: $\frac{8760 \text{ hr} \times 25 \text{ kW} \times \$1.03/\text{gal}^*}{12 \text{ kWh/gal}} = \$18{,}800$

#

TABLE 24-13. UTILITIES AND POL

| Item | Factor |
|---|---|
| Annual Operating Hours | 8760 hrs/yr |
| Fuel Consumption (grade DF-2 fuel oil) | 12 kWh/gal |
| DF-2 Fuel Oil Cost (delivered) | $ 1.03/gal |
| Commercial Electricity Cost (large CONUS base) | |
| Reimbursable rate | $ 0.053/kWh |
| Government rate | .048/kWh |

NOTE: Base Year is FY 1984.

Source: DFSC Price Bulletin; Andrews AFB; DCA, Code 690, May 84.

c. Heating.

(1) General.

(a) To estimate operating fuel requirements for heating equipment, it is necessary to consider type of construction, season, zone, and other climatic factors, cubic footage of area to be heated, gross loss of heat, equipment and lighting heat input, and efficiency ratings of heating equipment.

---

*Current prices may be used because of rapidly changing fuel cost; however, the date and source of current prices should be included as a footnote.

(b) Basic guidelines used by civil engineers in computing heating cost estimates are as follows:

1. The building heating equipment is designed to maintain 75 degrees indoor temperature during daily operating conditions at outdoor winter design conditions established for the geographical area. In addition, the heating system should have a minimum capacity to maintain 50 degrees indoor temperature without operation of communications equipment or lights at outdoor winter design conditions. Heating equipment generally operates at 80-percent efficiency, and may use one or more fuels.

2. When diesel generators are in use, heating equipment normally will use the same type of fuel; i.e., number two fuel oil or grade 2-D diesel fuel. British thermal unit (Btu) output increases in proportion to the weight of the fuel.

(2) Use of Table. To estimate costs where only general seasonal, climatic, and geographical factors are known, assume the building will be designed to meet the minimum temperature standard (50 to 65 degrees) for the building area where heating is absolutely essential. Consider the location required (e.g., mountainous or windy) and multiply the cubic footage of the building to be heated by the appropriate factor from table 24-14 for gallons per cubic foot of space. Utilize the 55-degree-day table for buildings not normally occupied and the 65-degree-day table for occupied buildings. Adequate heat to maintain 65 degrees plus gains from equipment and lights will provide necessary working and living conditions for communications maintenance and operational personnel.

(3) Estimating Procedures.

(a) Multiply cubic feet of building space by the appropriate factors from table 24-14.

(b) Multiply total gallons of heating fuel obtained by the cost factor in table 24-13 for number two fuel oil to obtain the annual cost for heating.

(4) Example. Heating costs are to be estimated for a remote LOS microwave site located within 60 miles of Olathe, Kansas. The building complex will be insulated, with a ceiling height of 10 feet, and will contain barracks, mess, recreation, and support facilities for 15 communications and 6 support personnel (military) in addition to operational communications equipment. Required square footage is shown below.

TABLE 24-15. CONTRACTOR LABOR COSTS (U.S. NATIONALS) - R&D STUDIES (CON.)

| Occupational Category | Hourly Rate | Annual Rate | Annual Cost To User |
|---|---|---|---|
| Support | | | |
| Secretarial/Tech Typing | 5.19 | 10,800 | 25,900 |
| Clerical | 3.70 | 7,700 | 18,500 |

Source: 1977/78 Contract Data

TABLE 24-16. CONTRACTOR LABOR COSTS (U.S. NATIONALS) - CONTRACTS TO ENGINEER, FURNISH, INSTALL COMMUNICATION SYSTEMS

| Occupational Category | Hourly Rate | Annual Rate | Annual Cost To User | |
|---|---|---|---|---|
| | | | CONUS | Overseas* |
| CONUS | | | | |
| Systems Engineer | $ 9.30 | $19,300 | $45,700 | - |
| Senior Engineer | 11.67 | 24,300 | 57,600 | - |
| Project Engineer | 8.96 | 18,600 | 44,100 | - |
| Draftsman | 7.36 | 15,300 | 36,300 | - |
| Clerical | 4.14 | 8,600 | 20,500 | - |
| Project Manager | 20.40 | 42,400 | 100,500 | - |
| OVERSEAS* | | | | |
| Senior Field Engineer | 8.35 | 17,400 | - | $28,800 |
| Field Engineer | 6.83 | 14,200 | - | 23,500 |
| Installation Supervisor | 10.80 | 22,500 | - | 37,200 |
| Test & Acceptance Supervisor | 9.89 | 20,600 | - | 34,100 |
| Technician | 5.35 | 11,100 | - | 18,400 |

*Overseas costs to user are lower than CONUS rates because most corporations have their field activities in a separate overhead pool which has a lower departmental burden. However, workers overseas are usually paid for a 48-hour week, and incentives are paid to personnel who remain overseas for a specified period. These incentives are additional to labor costs shown above, and they range in value from approximately 20 percent in Europe to 20 to 30 percent in the Middle East and the Pacific and up to 70 percent for hazardous and extreme climatic conditions.

Source: 1977/78 contract data.

TABLE 24-17. CONTRACTOR LABOR COSTS (U.S. NATIONALS) - CONTRACTS FOR MANUFACTURE OF COMMUNICATIONS EQUIPMENT

| Occupational Category | Hourly Rate | Annual Rate | Annual Cost To User |
|---|---|---|---|
| Engineering Manager | $14.97 | $31,100 | $79,000 |
| Industrial Engineer | 9.81 | 20,400 | 51,800 |
| Engineering Specialist | 13.95 | 29,000 | 73,700 |
| Sr Engineering Specialist | 15.95 | 33,200 | 84,300 |
| Technician | 7.84 | 16,300 | 56,400 |
| Fabrication Plant | 6.12 | 12,700 | 43,900 |
| Model Shop Wireman | 5.93 | 12,300 | 42,600 |
| Assembler | 4.75 | 9,880 | 38,200 |
| Quality Control | 8.79 | 18,300 | 63,300 |

Source: 1977/78 contract data.

h. Independent Government Cost Estimate for Scientific, Engineering, and Technical Support Contracts.

(1) General.

(a) This paragraph provides guidance for the preparation of independent Government planning and budget cost estimates for contracts providing management and scientific analysis, and engineering and technical support. The use of the suggested formats is not mandatory, # unless so stated by other DCA documents. This paragraph does not apply to contracts for the acquisition of hardware, for the operation of communications systems, nor for the maintenance of these systems. It does # apply to contracts that are labor-intensive and usually involve only small amounts of material and equipment.

(b) If no new contract is being considered, but rather a continuing effort, use actual cost figures, adjusted for changes in price levels and in scope of work. The actual cost figures can be compared to the original independent Government estimate to help improve the estimating process and to point out areas where more cost control is needed. If a new contract is planned to be awarded by Sole Source to a known contractor, the best estimating method is analogy with current and past efforts of the same contractor. Again, adjustments for price level changes must be made. If the work will be done by an FCRC contractor or is similar to that done by an FCRC contractor, see paragraph (6), below. Otherwise it is best to use the method detailed below. Even in the above three cases, it is beneficial to also use the following method as it enforces a more thorough consideration of cost.

(c) The cost estimate is based on the Statement of Work (SOW) which describes the tasks to be performed (see DCAI 260-70-3, Project Monitor's Handbook for the Preparation and Processing of Acquisition Actions, chapter 6). The SOW provides a link between the Government's requirement and the corresponding cost. First, the total contract price is estimated, using the categories: Direct Labor Charges (DLC), Indirect Labor Charges (ILC), Other Direct Charges (ODC), General and Administrative (G&A), and Fee, described in paragraph (3), below. These costs are then distributed over the performance years of the proposed contract. Finally, the time-phased costs are adjusted to include the effects of inflation on budgetary estimates.

(d) Cost estimating for these contracts begins with an analysis of the stated requirements to determine the categories of effort and the quantity of each category of effort the project tasks will require. The office preparing the SOW must describe the requirement specifically but without needlessly going into the details of the contractor's approach to the tasks. The requirement should be divided into well-defined tasks and an end product described for each. Examples of end products include milestone schedules, literature reviews, block diagrams of computer programs, functional specifications for switching devices, and working prototypes of an item. Some suggestions are provided below on relating the tasks identified above to the corresponding labor requirements.

1. Decide whether the tasks and their interrelationships are simple or complex. Decide also whether the tasks are state-of-the-art or routine. A literature review or interviews may be required.

2. Decide on a unit of measure for labor. For estimating purposes the concept of a Technical Staff Month (TSM) is suggested. A TSM is defined as 1 month of a professional, technical, or scientific person's time directed to the performance of the tasks in the SOW. TSM should not include general management or supervision unless the supervisor or manager is assigned and identified to the individual project; nonproductive time, such as leave and holidays; and administrative,

secretarial, clerical, and graphics support personnel. The costs for these items are included in ILC (see paragraph (3)(b), below).

3. Meet with previous Contracting Officer's Technical Representatives (COTR's) experienced in similar work and review the contracts to help quantify the relationship between the level of contractor staffing and the corresponding outputs for the proposed tasks. Review of this historical data is easier to accomplish and provides a more accurate estimate of TSM if the project has been divided into well-defined tasks. Exercise caution when using historical data to estimate TSM, especially when contracts are not very similar or the tasks are state-of-the-art R&D efforts. Consider also that the relationship between the number of TSM required and project size is not a linear one. Large projects require additional TSM for integration and coordination requirements.

4. Reference texts that address requirements definition and methods for estimating TSM requirements are available in the DCA Technical Library and the DCEC Technical Library. However, regardless of the method used to estimate the TSM, the estimate still relies heavily on expert judgment.

5. At the end of this phase, the project monitor should have a planning estimate for the categories and amounts of TSM required and also a preliminary project schedule. The Independent Cost Estimate Worksheet can now be completed.

(2) Derivation of Factors.

(a) The salaries in table 24-18 were adapted from Bureau of Labor Statistics and National Society of Professional Engineers salary surveys. The use of more relevant salary data, when available, is encouraged.

(b) The loading factors below for Indirect Labor Charges, G&A, and Fee were developed from a study of task order contracts.

(3) Preparation of Independent Government Estimates. The Independent Cost Estimate Worksheet (figure 24-3) is used to prepare independent estimates. It provides guidance for calculating Direct Labor Costs (DLC), Indirect Labor Costs (ILC), Other Direct Costs (ODC), G&A, Contractors' Fee, and Total Cost. Other quantities, specifically the average cost per TSM and the comparison ratio, are also calculated on this worksheet to allow convenient comparison to other contractual efforts.

(a) To calculate DLC, enter the number of TSM's required for each category of effort identified. Using table 24-18, determine the monthly salary level for each category of effort identified. Multiply the TSM by the monthly salary and sum the results to arrive at the DLC.

#

TABLE 24-18. CONTRACTOR SALARIES FOR SCIENTIFIC, ENGINEERING, AND TECHNICAL SUPPORT

| | Monthly Salary | Total Cost ILC Factor = 1.25 | Total Cost ILC Factor = 1.50 |
|---|---|---|---|
| **Engineers** | | | |
| Senior Engineers | $5,109 | $14,668 | $16,298 |
| Midlevel Engineers | 3,819 | 10,965 | 12,183 |
| Junior Engineers | 2,789 | 8,008 | 8,898 |
| **Programmers** | | | |
| Senior Programmers | 2,756 | 7,913 | 8,794 |
| Junior Programmers | 1,940 | 5,570 | 6,188 |
| **Engineering Technicians** | | | |
| Senior Technicians | 2,168 | 6,225 | 6,917 |
| Junior Technicians | 1,574 | 4,519 | 5,022 |

Note: Total Cost uses G&A rate of 16% and Fee rate of 10%.

Source: 1983 NSPE Income and Salary Survey and 1982 BLS Survey, both updated to FY 84.

(b) Indirect Labor Charges (ILC) include all labor costs chargeable to the contract other than the salaries of the professional, technical, and scientific persons included under DLC above. ILC covers the salaries of the administrative, secretarial, clerical, and graphics support personnel. ILC also covers the employee benefits, social security, workmen's compensation, and an amount for nonproductive time for all persons charged to this contract. An analysis of recent DCA contracts showed that ILC, using this definition, ranged from 87 percent to 211 percent of DLC with an average value of 150 percent. Table 24-19 shows how the ILC rate varied for different categories of tasks. For planning purposes, without better information such as prior contracts for very similar work, use table 24-19 if the task falls into one of the categories of the table. Use an ILC factor of 1.25 for Senior Engineers and Analysts and otherwise use the formula:

$$ILC = 1.5 \times DLC$$

(c) Other Direct Charges (ODC) cover travel (including transportation, per diem, and rental cars), material, equipment, ADP, consulting, subcontracts, and other items. These items can only be identified and priced after development of a more specific knowledge of the required tasks. Many of these items can be priced by using readily available sources (e.g., airline fares, equipment catalog prices, rental car schedules). ADP equipment prices can be found in Auerbach Computer Technology reports, or other reference sources.

TABLE 24-19. ILC FACTORS FOR SCIENTIFIC, ENGINEERING, AND TECHNICAL SUPPORT CONTRACTS

| Category | ILC Factor |
|---|---|
| Management Analysis, Math Modeling, Operations Research | 1.75 - 2.00 |
| Test Design and Implementation, Technical Assistance, Computer Programing | 1.25 - 1.75 |
| Engineering Support, Data Collection, Update Previous Studies | .90 - 1.25 |

Source: Code 690 study of DCA contracts, 1980.

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**INDEPENDENT GOVERNMENT COST ESTIMATE**

| CONTRACT NUMBER | TASK ORDER |
|---|---|
| | AMENDMENT |

**1 DIRECT LABOR CHARGES**

| CATEGORY OF EFFORT | NUMBER OF MONTHS | | MONTHLY SALARY* | | |
|---|---|---|---|---|---|
| | | x | | = | |
| | | x | | = | |
| | | x | | = | |
| | | x | | = | |
| | | x | | = | |
| TOTALS | | (TSM) | | | (DLC) |

AVERAGE COST PER TSM = DLC/TSM = _____

**2 INDIRECT LABOR CHARGES**

ILC = (DLC) X (LOADING FACTOR) = _____ X _____ = _____ (ILC)

COMPARISON RATIO = (DLC + ILC)/TSM = _____

**3 OTHER DIRECT CHARGES**

| | | |
|---|---|---|
| TRAVEL | = | |
| MATERIAL | = | |
| EQUIPMENT | = | |
| ADP | = | |
| SUBCONTRACT | = | |
| OTHER (Specify) | = | |
| TOTAL | = | (ODC) |

SUBTOTAL A = (DLC) + (ILC) + (ODC) = _____ (A)

**4 GENERAL AND ADMINISTRATIVE (G&A)**

G&A = (A) X (G&A LOADING FACTOR) = _____ X _____ = _____ (G&A)

SUBTOTAL B = (DLC) + (ILC) + (ODC) + (G&A) = _____ (B)

**5 FEE**

FEE = (B) X (Fee Rate) = _____ X _____ = _____ (FEE)

**6 TOTAL COST**

TOTAL = (DLC) + (ILC) + (ODC) + (G&A) + (FEE) = _____ (TOTAL)

*Note—Costs are estimated in constant FY _____ dollars.

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FIGURE 24-3. INDEPENDENT COST ESTIMATE WORKSHEET

(d) General and Administrative (G&A) charges cover companywide costs (for example, office space and insurance) that the contractor will allocate to the contract. G&A in recent contracts has usually ranged from 14 percent to 18 percent of the total of DLC, ILC, and ODC. However, values outside this range were also observed. For planning, unless better information is available, use the formula:

$$G\&A = .16 \times (DLC + ILC + ODC)$$

(e) The element Fee covers the profit or fee to the contractor. The amount for fee is subject to negotiation and depends on the degree of contractor risk, the value of contractor facilities, and other factors. The DCA contracts researched were of the cost-plus-fixed-fee type (low risk to the contractor), and the fee ranged in the area of 10 percent of the total cost of DLC, ILC, ODC, and G&A. For planning, unless better information is available, use the formula:

$$Fee = .10 \times (DLC + ILC + ODC + G\&A)$$

(4) Time-Phasing the Planning Estimate. For budget purposes the cost figures derived above on the Independent Cost Estimate worksheet must be distributed over the duration of the contract and also adjusted for inflation. Paragraph (a) below shows how to spread these constant dollars over the duration of contract performance, and paragraph (b) below shows how to adjust the time-phased, constant-dollar costs to include the effects of inflation during the contract period.

(a) First, spread the total constant-dollar amount into specific amounts for each fiscal year. For DLC and ILC, use proportions. Allocate the dollars for these elements in each fiscal year proportional to the number of TSM expended in that year. Projects that take place entirely in one fiscal year do not have to be time phased. The SOW may suggest how quickly the tasks are to be performed (for example, a surge effort with minimal follow-on, or alternatively, an even level of effort throughout). For ODC, the time phasing requires a knowledge of each of the items and when they are required. The time phasing of G&A and Fee can be based on the same proportions as were used for DLC, ILC, and ODC, above. After spreading these costs over the fiscal years of the contract (i.e., before adjusting to include the effects of inflation) the total amount should be the same as the total constant-dollar amount originally developed.

(b) For budget purposes it is necessary to calculate the Total Obligation Authority (TOA) required in each fiscal year. The TOA figures are developed from the time-phased, constant-dollar costs developed in paragraph (a), by adjusting for the effects of price level changes and outlay rates. Table 38-3 (Weighted Price Level Indexes) gives a specific index for each fiscal year. The following formula is used:

# TOA = Constant Dollar Costs X Index/100

Chapter 38 provides further discussion on how to use these indexes.

(5) Example, Using Worksheet to Prepare Planning Estimate.

(a) Using data and scenarios prepared by DCA, the contractor will analyze the capability of a proposed hardened cable communications network to endure several types of natural disasters, such as earthquake and fire. Several types of cable will be provided as Government Furnished Material (GFM), and the contractor will perform testing at the contractor's own facility, assumed in this example to be a local one. It is not possible to specify exactly how many tests will be run, because the plan requires that the contractor use an iterative search procedure in which the results of each stage are analyzed before deciding how to continue. There will be, however, not fewer than 12 and not more than 36 tests. The contract will start at the # beginning of the third quarter of FY 1984 and run for 2 years. Costs for this example will be estimated first in constant FY 1984 dollars. Then the TOA will be calculated.

(b) On the basis of the Statement of Work and a knowledge of similar projects, it is estimated that a contractor will assign four professionals, each devoting half his or her time to this project (the other # half to another, unrelated project). There might be a mid-level engineer, two junior engineers, and an engineering aide. Figure 24-4 shows under Direct Labor the types of effort and the number of months for each. Enter the monthly salaries under Direct Labor Charges. The ILC loading factor (from table 24-19) is estimated to be 1.5, and is entered under Indirect Labor Charges. Since the contractor will use GFM at the local facility, the contract should have no material or travel. The contractor should already have any necessary test equipment. Other Direct Charges, then, are estimated at zero. The suggested G&A loading factor of .16 is considered appropriate, and is entered on line 4 of the worksheet. Likewise, a Fee rate of .10 is entered on line 5. The total contract cost estimate, in constant dollars, is # then $442,708, as shown on line 6 of figure 24-4.

# (c) A constant level of effort is assumed for this contract, which runs for eight quarters -- two in FY 1984, four in FY 1985, and two in FY 1986. The use of proportions (one-eighth of the constant-dollar total in each quarter) gives time-phased constant-dollar costs as follows:

| # Fiscal Year | FY 1984 | FY 1985 | FY 1986 | Total |
|---|---|---|---|---|
| Cost (Constant FY 1984 $) | $110,677 | $221,354 | $110,677 | $442,708 |

(d) The Total Obligation Authority for this example is calculated by using the RDT&E indexes from an FY 1984 base year version of table 38-3 of this manual. First divide these indexes by 100, and then multiply the constant-dollar costs above as follows:

| # Fiscal Year | FY 1984 | FY 1985 | FY 1986 | Total |
|---|---|---|---|---|
| Cost (Constant FY 1984 $) | $ 110,677 | $221,354 | $110,677 | |
| Index | 1.029 | 1.078 | 1.125 | |
| TOA (Current $) | $ 113,887 | $238,620 | $124,512 | $477,019 |

The Total Obligation Authority is presented on DCA Form 9: Summary Sheet.

**INDEPENDENT GOVERNMENT COST ESTIMATE**

| CONTRACT NUMBER | TASK ORDER |
|---|---|
| Hardened Cable Example | AMENDMENT |

**1. DIRECT LABOR CHARGES**

| CATEGORY OF EFFORT | NUMBER OF MONTHS | | MONTHLY SALARY* | | |
|---|---|---|---|---|---|
| Midlevel Engineer | 12 | x | $3,819 | = | $45,828 |
| Junior Engineer | 24 | x | 2,789 | = | 66,936 |
| Senior Technician | 12 | x | 2,168 | = | 26,016 |
| | | x | | = | |
| | | x | | = | |
| TOTALS | 48 (TSM) | | | | $138,780 (DLC) |

AVERAGE COST PER TSM = DLC/TSM = $2,891

**2. INDIRECT LABOR CHARGES**

ILC = (DLC) X (LOADING FACTOR) = 138,780 x 1.5 = 208,170 (ILC)

COMPARISON RATIO = (DLC + ILC)/TSM = 4,337

**3. OTHER DIRECT CHARGES**

| | |
|---|---|
| TRAVEL | = |
| MATERIAL | = |
| EQUIPMENT | = |
| ADP | = |
| SUBCONTRACT | = |
| OTHER (Specify) | = |
| TOTAL | = 0 (ODC) |

SUBTOTAL A = (DLC) + (ILC) + (ODC) = 346,950 (A)

**4. GENERAL AND ADMINISTRATIVE (G&A)**

G&A = (A) X (G&A LOADING FACTOR) = 346,950 x .16 = 55,512 (G&A)

SUBTOTAL B = (DLC) + (ILC) + (ODC) + (G&A) = $402,462 (B)

**5. FEE**

FEE = (B) X (Fee Rate) = $402,462 x .10 = 40,246 (FEE)

**6. TOTAL COST**

TOTAL = (DLC) + (ILC) + (ODC) + (G&A) + (FEE) = $442,708 (TOTAL)

*Note – Costs are estimated in constant FY 84 dollars.

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FIGURE 24-4. HARDENED CABLE EXAMPLE

(6) Federal Contract Research Centers. There are six Federal Contract Research Centers (FCRC's), three of which are used by DCA as shown in table 24-20. These are nonprofit organizations primarily engaged in providing independent specialized technical and scientific support to DoD. FCRC's charge a fixed fee per TSM (table 24-20). This is a loaded fee that includes ILC, G&A, and Fee discussed previously.

(a) To prepare an independent estimate for an FCRC contract effort, the types and amounts of effort required to perform the tasks are identified in the SOW as described in paragraph (1)(c) above.

(b) Multiply the total number of TSM required by the cost per TSM from table 24-20.

(c) Use the Independent Cost Estimate Worksheet to complete the estimate. Do not, however, complete section 2 (Indirect Labor Charges), section 4 (G&A), or 5 (Fee), as the costs for these items are included in table 24-20.

(d) Time phasing of planning estimates for FCRC's is accomplished as described in paragraph (4).

TABLE 24-20. FEDERAL CONTRACT RESEARCH CENTERS

| FCRC | Fee per TSM |
|---|---|
| Institute for Defense Analysis (IDA) | $10,400 |
| Lincoln Labs | 11,150 |
| MITRE | |
| CONUS | 9,200 |
| Europe | 15,400 |
| Pacific | 13,750 |

# Note: Base Year is FY 1983

Source: Code 690, Sep 82.

6. Security Clearances.

a. General. The U.S. Government incurs expenses for investigations of all personnel who require access to information which has been classified in the interests of national security. Investigations of employees of, and contractors for, the military departments and defense agencies are conducted by the Defense Investigative Service (DIS).

b. Derivation of Costs. Table 24-18 presents average costs for background investigations ("BI") and BI Bring-ups on DCA personnel. Included are costs of "full field" DIS investigations and National Agency Checks, as well as Security Division costs associated with converting investigations into clearances. BI Bring-ups are updates conducted on individuals at 5-year intervals. To determine a recurring annual cost, divide the tabled cost by 5. When an overseas check is required for military personnel, it is conducted by the applicable military department.

TABLE 24-21. SECURITY CLEARANCE COSTS

| Item | Cost |
|---|---|
| Background Investigation | $330 |
| BI Bring-up (every 5 years) | 75 |
| Overseas Check | 30 |

Source: DIS, DCA Code 330, and DCA Code 690 as of Jun 78.

(4) Example. LOS total equipment costing $857,000 requires contractual support available from a host base.

$857,000 X .003 = $2,571 annual cost

d. Contractor-Operated Base Markups.

(1) General. A review of current contracts revealed a wide range of contractual support costs. It is necessary to apply the personnel costs of the local country as shown by table 24-5 to the technical and clerical personnel costs of the U.S. contractor. Costs in table 24-15 for engineering and key personnel of the contractor already incorporate these support costs.

(2) Use of Table. Table 24-22 contains cost factors and instructions as to application of the markup to cost estimates developed in accordance with other parts of this Circular; e.g., cost markup on salaries or material purchase prices. These factors should be used only when the salaries of personnel or material purchase prices exclude overhead and miscellaneous support costs.

(3) Estimating Procedure.

(a) Consider the type of personnel trained to operate the transmission media as well as the climatic factors, the geographical area, and the political situation of the foreign country. When adequate personnel are available from a nearby city, the amount of required personnel housing and other support will decrease. Conversely, if the base is to be operated in a remote desert, all personnel support must be included in the base facility complex. The estimate must incorporate the contractor's cost and overhead and profit. Contractor costs are subject to, and directly affected by, the foreign country's political situation and customs, a factor difficult to evaluate but necessary to consider.

(b) Use the basic factors and block diagrams available in this Circular for estimating equipment, supplies, spare parts, other material, transportation, etc., anticipated to be furnished by contract. Separately identify the subtotals of the various categories of cost; apply the overhead factors to the categories; compute the direct costs which include personnel overhead; apply the additional factor for overhead, taxes and profits; and total. Determine the appropriate totals and apply the factors in table 24-22.

#

TABLE 24-22. MISCELLANEOUS O&M FACTORS

| Item | Mark-up Percentage |
|---|---|
| Annual Costs | |
| Maintenance and Acquisition of Buildings | 5 % |
| Supplies and Equipment | 3 |
| Military Base Contractual Services (excludes DECCO and contractor-operated base) | |
| Host-Tenant Support Available | 0.3 |
| Host-Tenant Support Not Available | 1 |
| Contractor-Operated Base Markups | |
| Personnel Overhead: Increase Salaries for Civilians (U.S. or foreign) | 25 |
| Processing and Handling of Materials: Increase Total Purchase Price | 6 |
| Other Overhead: Increase Total for Direct Cost Plus Above Percentage Markups | 5 |
| U.S. Taxes and Profit: Increase All Costs and Prior Markups | 10 |

Source: DCA, Code 690, current as of Feb 76.

Access Line (assume A - B rates):

| | | |
|---|---|---|
| Fixed fee | $341.27 | |
| 10 miles @ $0.93 | 9.30 | |
| Total Cost (chapter 30, table 30-1) | | 351 |

Backbone Service (table 28-1):

| | | |
|---|---|---|
| Europe + CONUS service | $1,055 | |
| with Immediate precedence | x 3 | |
| | | 3,165 |

Total Budgetary Cost-to-the-User (per month) $ 3,731

e. Cost-to-the-Government. The CSIF charges for the AUTOVON backbone are not included in the calculation of the economic cost-to-the-Government. In the example above, delete the $3,165 for the backbone. The cost-to-the-Government is the termination and access line cost.

4. AUTODIN.

a. General.

(1) AUTODIN subscriber charges are based upon the category and speed of service. AUTODIN services were designed with narrative record service as the primary application. Subsequent modifications have added query/response service for data base transactions and sequential delivery service for applications, such as facsimile, where the order of arrival is important. Reference material for the AUTODIN services are DCAC 310-D70-60, Operating Procedures for Query/Response Service, and DCAC 310-D70-63, Operating Procedures for Sequential Delivery Service. These describe the basic AUTODIN transmission service (secure message switched service at speeds up to 4800 b/s). Many kinds of communications can be obtained through AUTODIN depending upon the terminal equipment. Examples include teletype, facsimile, or computer magnetic tape transfer. The number of approved terminal devices is too large for inclusion here; cf. DCAC 310-D130-3, Approved DCS AUTODIN Terminal (Hardware and Software) Systems.

(2) In addition to the monthly rates for the backbone service, the users must pay the cost of leased access lines (paragraph 7, chapters 29 and 30) and any other charges imposed by the carriers in their area. The charge for termination of the access line at the user's site and the switch is given in paragraph 9. The terminal equipment itself is additional. Further information on modes of operation, speed of service, terminal equipment, etc., may be obtained from the references cited above.

b. Use of Tables. Table 28-2 presents backbone rates for regular and query/response AUTODIN services. For example, a user wanting low-speed regular AUTODIN service should plan upon a budgetary expense for backbone # charges of ($835 x 2 =) $1,670 during FY 1984. The computations for AUTODIN service are similar to those required for AUTOVON. See paragraph 3d.

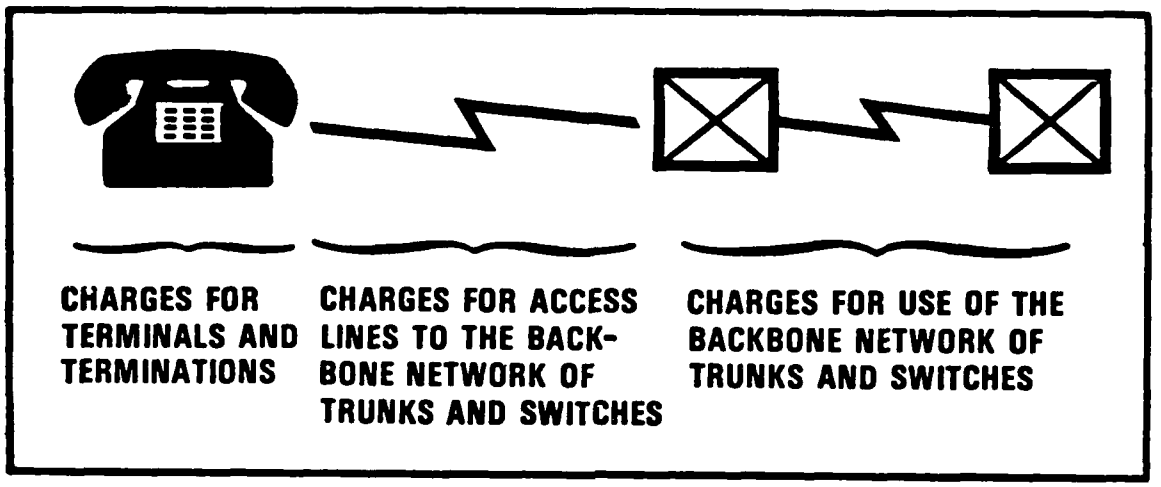


FIGURE 28-1. ILLUSTRATION OF AUTOVON COST ELEMENTS

c. Cost-to-the-Government. Adequate capacity exists within the store-and-forward switches and interswitch trunks to accommodate reasonable increases in demand without additional expenditure for resources. Thus, there is no out-of-pocket cost for added load on the backbone AUTODIN network. Such costs may be incurred for access lines and terminal equipment. In the case of a user leaving a dedicated network and substituting AUTODIN service, there will usually be a savings to the Government as the access lines will be cheaper than the displaced network.

# 5. ARPANET. The ARPANET is an intercomputer packet-switched network linking DoD-sponsored research centers and activities in CONUS, Hawaii, Norway, and the United Kingdom. The network can process bulk and interactive data communications. The transit time of a message is normally less than 250 ms. The CSIF fee for the ARPANET is computed on a node (TIP/IMP) basis regardless of the amount of traffic which enters or exits the network through the node. An existing node may be expanded by means of a BBN C/30 IMP or TAC to accommodate additional hosts. CSIF planning rates are shown in table 28-3. The user must pay for access to the node and for the termination charges.

# TABLE 28-1. AUTOVON CSIF PLANNING RATES

| Maximum Calling Area (MCA) | FY 1985 Monthly Rate Per Weighted Unit |
|---|---|
| Local | |
| Europe | $ 25 |
| Pacific | 150 |
| Area | |
| CONUS | 685 |
| Europe | 49 |
| Pacific | 409 |
| CADIN (Air Force only) | 678 |
| Area Plus | |
| CONUS & Europe | 1,034 |
| CONUS & Pacific | 1,268 |
| CONUS & Caribbean | 828 |
| Global | 1,762 |

| Preemption Capability | No. of Weighted Units |
|---|---|
| Flash | 4 |
| Immediate | 3 |
| Priority | 2 |
| Routine | 1 |

NOTE: For Phone/Data and PBX (Send Only) Service, double the charge shown.

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 16 Feb 84, DCA, Code 670.

# TABLE 28-2. AUTODIN CSIF PLANNING RATES

FY 1985 Monthly Rates

| Speed of Service | Regular Service: No. of Weighted Units | Regular Service: Rate Per Access Line[1] | Query/Response[2]: Area | Query/Response[2]: Area Plus | Query/Response[2]: Worldwide |
|---|---|---|---|---|---|
| High Speed | | | $2,500 | $3,500 | $4,500 |
| 4.8 kb/s | 12 | $10,020 | | | |
| 2.4 | 8 | 6,680 | | | |
| Medium Speed | | | 1,300 | 1,900 | 2,500 |
| 1.2 | 6 | 5,110 | | | |
| 0.6 | 4 | 3,340 | | | |
| Low Speed | | | 600 | 800 | 1,000 |
| 0.3 or less | 2 | 1,670 | | | |

NOTES: [1]Charge per Weighted Unit is $835.
[2]Charges include access to one terminal or host. Add $100 for each additional terminal/host accessed.

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 16 Feb 84; DCA, Code 670.

# 6. Defense Data Network (DDN). CSIF charges for the DDN are currently set at flat monthly rates for all DoD activities, based on their projected usage. For non-DoD activities, the rates are based on cost per month for each occupied IMP host port. Generally, the non-DoD users represent those activities which have been transferred from ARPANET into the MILNET. Also included are all WWMCCS Intercomputer Network (WIN) customer activities. Separate WIN backbone rates have been discontinued as of FY 1985.

# TABLE 28-3. DDN & ARPANET CSIF PLANNING RATES

| | FY 1985 Monthly Rates |
|---|---|
| DDN | Flat rate for each DoD activity |
| ARPANET | $11,000 per node<br>+ 10% for each additional collocated IMP or TAC |

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 16 Feb 84; DCA, Code 670.

7. Multiplexed and Bulk Systems.

a. General. DCA operates several multiplex and bulk encrypted circuit systems to reduce the total cost of communications. The costs of the multiplexers and trunks are shared by the users. A DECCO management fee of 1 percent must be added to the stated rates. The decision as to the type and location of multiplex services is determined by an economic analysis. The guidelines for analysis and funding of multiplex systems are found in DCAC 310-70-59, DCA Management of DoD Multiplex Systems. The economic analysis examines whether a multiplex system should be installed in a particular area. A different economic analysis would be required to determine whether it would be cost effective to activate another circuit over an existing route. As in all systems operated by the CSIF, the user must fund any access lines needed to reach the multiplex network.

b. Transoceanic Service. Table 28-4 lists the routes and rates for transoceanic channel packing and voice frequency carrier telegraph (VFCT) service. Nonstandard expenses, such as connection to a circuit not compatible with the DCS multiplex or special routing expenses, will be charged to the user. Costs of a circuit to other areas will be prorated among all users of the circuit until a standard rate can be established for the circuit.

c. CONUS Voice Frequency Carrier Telegraph (VFCT). Table 28-5 lists the current location of VFCT nodes and the per mile charge.

# TABLE 28-4. TRANSOCEANIC MULTIPLEX SERVICE CSIF PLANNING RATES

| | | | FY 1985 Monthly Rates | |
|---|---|---|---|---|
| | | | 75 b/s | 2,400 b/s |
| CONUS | - | Europe | $ 525 | $7,900 |
| | - | Puerto Rico | 320 | N/A |
| | - | Bermuda | 400 | N/A |
| | - | Canal Zone | 650 | N/A |
| | - | Japan | N/A | 9,200 |
| East Coast | - | Hawaii | 400 | 3,900 |
| | - | Guam | 740 | N/A |
| | - | Australia | 1,290 | N/A |
| West Coast | - | Hawaii | 450 | 2,300 |
| | - | Guam | 790 | N/A |
| | - | Japan | 370 | N/A |
| | - | Australia | 1,340 | N/A |
| Hawaii | - | Guam | 340 | 4,450 |
| | - | Philippines | 415 | 5,410 |
| | - | Japan | 525 | 9,650 |
| | - | Australia | 890 | N/A |
| Guam | - | Philippines | 425 | 7,700 |
| | - | Japan | 680 | 8,700 |
| | - | Australia | 1,230 | N/A |
| Philippines | - | Japan | 1,780 | 15,200 |
| | - | Australia | 1,275 | N/A |

NOTE: 1200 b/s service is available at 50% of the 2400 b/s rate. Speeds less than 1200 b/s can be obtained as mult ·les of the 75 b/s rate.

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 16 Feb 84; DCA, Code 670.

# TABLE 28-5. CONUS VFCT LINKS

| End Points | | Airline Miles |
|---|---|---|
| Andrews AFB, MD | Ft. Detrick, MD | 46 |
| | Ft. Meade, MD | 18 |
| | Ft. Ritchie, MD | 65 |
| | Kelly, TX | 1,389 |
| | McClellan, CA | 2,376 |
| | Norfolk, VA | 145 |
| | Patrick, FL | 761 |
| | Pentagon, VA | 10 |
| | Stockton, CA | 2,377 |
| | W. Sweetgrass, MT | 1,860 |
| Boca Chica, FL | Homestead, FL | 105 |
| Cape Canaveral, FL | Vandenberg, CA | 2,376 |
| Ft. Detrick, MD | Ft. Leavenworth, KS | 933 |
| | Ft. Meade, MD | 45 |
| | Ft. Ritchie, MD | 22 |
| | McClellan, CA | 2,342 |
| | Norfolk, VA | 188 |
| | Patrick, FL | 789 |
| | Pentagon, VA | 41 |
| | Stockton, CA | 2,343 |
| Ft. Leavenworth, KS | Ft. Ritchie, MD | 927 |
| | Kelly, TX | 705 |
| | McClellan, CA | 1,423 |
| | Point Reyes, CA | 1,500 |
| | Offutt, NE | 145 |
| Ft. Ritchie, MD | Carlisle Barracks, PA | 38 |
| | McClellan, CA | 2,334 |
| | Pentagon, VA | 62 |
| | Stockton, CA | 2,335 |
| | Ft. Meade, MD | 60 |
| | Arlington, VA | 62 |
| Norfolk, VA | Boca Chica, FL | 912 |
| | Cutter, ME | 716 |
| | Pentagon, VA | 148 |

TABLE 28-5. CONUS VFCT LINKS (CON.)

| End Points | | Airline Miles |
|---|---|---|
| San Diego, CA | Long Beach, CA | 96 |
| | Stockton, CA | 435 |
| Whidbey Island, WA | Stockton, CA | 723 |

NOTE: FY 1985 CSIF monthly planning rate is $0.15 per airline mile. Services above 75 b/s will be charged as multiples of that rate.

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 16 Feb 84; DCA, Code 670.

#

TABLE 28-6. CONUS CHANNEL PACKING LINKS

| End Points | | Airline Miles |
|---|---|---|
| Alexandria, VA | Los Angeles, CA | 2,292 |
| | San Diego, CA | 2,255 |
| Cameron Station, VA | Kirtland, NM | 1,643 |
| | Wright-Patterson, OH | 381 |
| Ft. Ritchie, MD | Offutt, NE | 1,311 |

NOTE: FY 1985 CSIF monthly planning rate for 2.4 kb/s service is $0.50 per airline mile. Speeds over 2.4 kb/s are charged as multiples of that rate.

Source: DECCO Code D650, 5 Jul 79; "Communications Services Industrial Fund (CSIF) Planning Rates," 16 Feb 84; DCA, Code 670.

# TABLE 28-7. EUROPEAN CHANNEL PACKING SERVICE CSIF PLANNING RATES

Intra-Europe Links

| | | | |
|---|---|---|---|
| Croughton, UK | Coltano, IT<br>London, UK<br>Pirmasens, FRG<br>Rota, SP<br>Vaihingen, FRG | Pirmasens, FRG | Coltano, IT<br>Vaihingen, FRG<br>London, UK |
| | | San Vito, IT | Hellenikon, GR<br>Iraklion, GR |
| Boerfink, FRG | Gablingen, FRG | | |

NOTES: FY 1985 CSIF planning rate for 1.2 kb/s service is $1,250 per month. Services above 1.2 kb/s will be charged as multiples of that rate. Ft. Meade, MD, to Chicksands, UK, service at 1.2 kb/s is available at $5,440 per month.

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 16 Feb 84; DCA, Code 670.

# d. CONUS Channel Packing. CONUS channel packing provides for service at 1.2 kb/s, 2.4 kb/s, and higher speeds. Table 28-6 lists the current locations of and per-mile charges for CONUS channel packing nodes.

# e. European Channel Packing. European channel packing provides for service at 1.2 kb/s, 2.4 kb/s, 4.8 kb/s, and 7.2 kb/s. Table 28-7 lists the current locations of and per-mile charges for European channel packing.

f. Bulk Encrypted Circuits. 1.544 Mb/s systems are charged at the rates contained in table 28-8.

g. Washington Area Wideband Service (WAWS). The Washington Area Wideband Service (WAWS) is an all-digital, bulk-encrypted service which can go up to 90 mb/s. In addition to the security offered by bulk encryption, the WAWS hardware provides for high reliability and low bit error rate. Table 28-9 lists the WAWS service points and rates. The DECCO administration fee of one percent must be added to the WAWS charges.

#

TABLE 28-8. 1.544 MB/S CSIF PLANNING RATES

| System | FY 1985 Monthly Per Channel Charge |
|---|---|
| CONUS - Puerto Rico | $1,300 |
| West Coast - Hawaii | 2,300 |
| McClellan AFB, CA - Neklason Lake, AK | 1,250 |

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 16 Feb 84, DCA, Code 670

h. Defense Satellite Communications System (DSCS). DSCS provides worldwide communications to both tactical (mobile) and fixed locations of DoD and other authorized users. Congress has directed that a user charge system be established for the use of the DSCS. DCA has proposed that the user charge be administered as part of the CSIF. Users procuring their entire service (space plus ground) will be charged a monthly rate for each simplex (one-way) circuit depending upon the b/s requirement of the circuit. Two-way service is obtained by two one-way circuits. Users supplying their own earth terminals will pay only the space segment charges. The space segment charge will be based upon the line speed of each simplex circuit, but an adjustment will be required to reflect the operating characteristics of the user's earth terminal. Users obtaining an entire transponder will be charged in accordance with the percentage of the satellite's power and bandwidth contained in that transponder. As the exact rate structure has not yet obtained OSD approval, no rates can be presented at this time.

## SECTION F. GENERAL COST CONSIDERATIONS

## # CHAPTER 31. ADP COST ESTIMATING

1. General. This chapter contains cost tables and instructions to assist in supplying necessary cost data for determining the total life-cycle costs to the Government for proposed ADP systems. The data presented in this manner should be particularly suitable for evaluation during system source selection proceedings. Detailed instructions for using the worksheets in making lease versus buy comparisons may be found in chapter 39. The figures presented here are:

a. Figure 31-1: "Equipment Purchase and Maintenance Costs."

b. Figure 31-2: "Equipment Lease and Maintenance Costs."

c. Figure 31-3: "Vendor Software and Services Costs."

d. Figure 31-4: "Nonequipment Costs."

e. Figure 31-5: "Time-Phased Cost Summary."

2. Use of Worksheets. These figures are designed to give consideration to all procurement, installation, operating, maintenance, site preparation, and expendable supplies costs to be incurred in the ADP system operation. Each system being evaluated may require different combinations of these five worksheets. Only those appropriate to each situation should be used in requests for proposals. Any supplementary explanations which will ensure clarity of entries should also be included. All special or additional features attached to a component to complete the requirement should also be listed and priced beneath the component concerned. Although figures 31-4 and 31-5 have been prepared to accommodate 8 years of annual fund requirements, specific ADPE applications may require either fewer or more years for the expected system or equipment economic life. These figures should be adjusted, therefore, to accurately reflect the envisioned program.

3. Instructions for Figure 31-1: Equipment Purchase and Maintenance Costs.

a. Column 1: Equipment (Hardware) Item Description. Enter a brief descriptive title for each type of equipment. Equipment is to be grouped as follows, with subtotals for each:

(1) Central Processor and Main Storage. List all devices and equipment directly associated with the functioning of the central processor.

(2) Input/Output (I/O) and Control. List all I/O components and magnetic tape units, including related control units and devices.

(3) Auxiliary Storage. List proposed equipment providing immediate or random access storage, including related special devices.

(4) Remote Terminals. List proposed remote access equipment, including required interface components or special devices.

(5) Other. List other proposed components and special feature equipment not identified above.

b. Column 2: Model Number/Group. Enter the current model number for each equipment item listed.

c. Column 3: Equipment Condition Code. Indicate by symbol whether the equipment is either refurbished under warranty as new equipment (R), new (N), or refurbished equipment not under warranty as new equipment (R-NW).

d. Column 4: Quantity. Indicate the number of units of each type of equipment proposed.

e. Column 5: Unit Purchase Price. Enter the proposed unit purchase price. In evaluating bids enter the price as contained in the bid or proposal. When the worksheet is being used to estimate the costs of a proposed ADP system, enter the amount that is expected to be charged by the vendor. Many prices may be obtained from Federal Supply Schedules or from the manufacturer's price lists; however, these prices are often discounted by 20-50 percent when a sizable order is placed. The estimate must consider these discounts.

f. Column 6: Total Purchase Price. Multiply column 4, "Quantity," by column 5, "Unit Purchase Price," and enter the result in column 6.

g. Column 7: Maintenance Charges (Prime Shift Operation).[1] Enter the basic monthly charge for maintenance during the principal period of maintenance (PPM) for each type of equipment. If maintenance is to be provided during weekends, that cost should also be included and noted. (See page 31-10, paragraph 7b.)

h. Column 8: Maintenance Charges (Two-Shift Operation).[1] Enter the basic monthly maintenance charges for each type of equipment for both shifts during a two-shift system operation.

i. Column 9: Maintenance Charges (Three-Shift Operation).[1] Enter the basic monthly maintenance charges for each type of equipment for all shifts during a three-shift system operation.

---

[1]If the maintenance charges appear to be excessive, or their fairness cannot be determined, Government-provided maintenance costs will be estimated in accordance with DCAI 600-70-1 and chapter 43, this Circular.

4. Instructions for Figure 31-2: Equipment Lease and Maintenance Costs.

a. Column 1: Equipment (Hardware) Item Description. Enter a brief descriptive title for each type of equipment. Equipment is to be grouped as follows, with subtotals for each:

(1) Central Processor and Main Storage. List all devices and equipment directly associated with the functioning of the central processor.

(2) Input or Output and Control. List all I/O components and magnetic tape units, including related control units and devices.

(3) Auxiliary Storage. List proposed equipment providing immediate or random access storage, including related special devices.

(4) Remote Terminals. List proposed remote access equipment, including required interface components or special devices.

(5) Other. List other proposed components and special feature equipment not identified above.

b. Column 2: Model Number/Group. Enter the model number corresponding to each equipment item identified. This model number should be the same as that used in the most recent Authorized Federal Supply Schedule Price List.

c. Column 3: Equipment Condition Code. Indicate by symbol whether the equipment is either refurbished under warranty as new equipment (R), new (N), or refurbished without warranty (R-NW).

d. Column 4: Quantity. Indicate the number of units of each type of equipment proposed.

e. Column 5: Monthly Lease Cost. Enter the proposed monthly lease cost for each component proposed.

f. Column 6: Total Lease Cost. Multiply column 4, "Quantity," by column 5, "Monthly Lease Cost," and enter the result in column 6.

g. Column 7: Extra-Use Hourly Rate. If applicable, enter the extra-use hourly rate for each component.

h. Column 8: Maintenance Charges (Prime Shift Operation). Enter the basic monthly maintenance charge for the total proposed quantities of each type of equipment during the principal period of maintenance (PPM).

---

[1]See footnote 1, page 31-2.

| Equipment (Hardware) Item Description (1) | Model Number/ Group (2) | Equip. Condition Code (3) | Quantity (4) | Unit Purchase Price (5) | Total Purchase Price (4)X(5) (6) | Maintenance Charges | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Prime Shift Operation (7) | 2-Shift Operation (8) | 3-Shift Operation (9) |
| TOTALS: | | | | | | | | |
| Purchase | | | | | | | | |
| Monthly Maintenance | | | | | | | | |

FIGURE 31-1. EQUIPMENT PURCHASE AND MAINTENANCE COSTS

i. Column 9: Maintenance Charges (Two-Shift Operation). Enter the basic monthly maintenance charges for the total proposed quantities of each type of equipment for both shifts during two-shift system operation.

j. Column 10: Maintenance Charges (Three-Shift Operation). Enter the basic monthly maintenance charges for the total proposed quantities of each type of equipment for all shifts during three-shift system operation.

5. Instructions for Figure 31-3: Vendor Software and Services Costs.

a. Column 1: Software and Services Item Description. Enter a brief description of each of the proposed software items and services. Requirements are to be grouped as follows, with subtotals for each:

(1) Programing Aids (Software). List the proposed computer programs, routines, subroutines, languages, translation compilers, and related items to be provided either at the time of installation of the system or at any time during the system life.

(2) Technical and Programing Services. Identify the costs incurred to provide the programs.

(3) Training Services. Identify the costs associated with contractor-provided executive orientation; analyst, programer, and operator training; and other proposed training services. The proposed use of Government-furnished equipment, facilities, or personnel in support of training should be identified specifically and applicable costs shown.

(4) Documentation. Identify the total cost associated with the proposed quantities of manuals, programing routine descriptions, and programing aids to be provided.

(5) Preinstallation Compilation and Test Time. Identify total costs for the requirement.

(6) Other. Identify other proposed service or software items not included above, and provide an explanation on the basis of these costs in the general costing considerations narrative. (See page 31-10, paragraph 7f.) Costs for installing the system, consisting of components listed on worksheets illustrated in figures 31-1 and 31-2, will be entered in this column. In estimating these costs, assume that all site preparation work (figure 31-4) has been completed.

b. Column 2: Total Proposed Quantity. Indicate, where meaningful, quantities and measurement of units for each service or software item identified.

c. Column 3: Unit Purchase Price. Enter the proposed purchase price for one unit of the service or software item. Where not appropriate, leave blank.

d. Column 4: Total Purchase Price. Multiply column 2, "Quantity," by column 3, "Unit Purchase Price," and enter the product in this column; or enter the total proposed price for the Government to acquire ownership of the item. Where not appropriate, leave blank.

e. Column 5: Description (Monthly Charges). Identify the basis for charges which will be incurred on a recurring monthly basis; e.g., rental, lease, user charges, royalties, etc.

f. Column 6: Unit Price (Monthly Charges). Indicate the cost per unit for items described in column 5; e.g., cost per work-month, cost per hour used. Where not appropriate, leave blank.

g. Column 7: Total (Monthly Charges). Enter the total monthly charges for the items described in column 5. Note that the respective quantities for these items are not required. Where not appropriate, leave blank.

h. Column 8: Total Annual Charges. For the items described in column 5 which represent charges during system operation, enter the product obtained by multiplying the appropriate entries in column 7 by 12 (months/year). Where not appropriate, leave blank.

6. Instructions for Figure 31-4: Nonequipment Costs.

a. Column 1: Cost Element. List all costs for items other than equipment in the following structure:

(1) Site Preparation. List costs to be incurred for the following:

(a) Building Requirements.

1. Floor Construction. Enter costs for construction of raised floors or treatment of floors, including carpeting, for resistance to static electricity.

2. Acoustical Treatment. Enter costs for acoustical treatment of doors, ceilings, and walls to prevent transmission of noise.

3. Lighting. Show costs involved to ensure adequate lighting.

4. Safety Equipment. Include all costs for fire extinguishers, sprinkler systems, etc.

5. Air-Conditioning. Show costs incurred for air-conditioning the building.

6. Space for Contractor Use. Furnish costs incurred in providing or preparing an area for use by the contractor for offices, storage of miscellaneous spare parts, etc.

| Equipment (Hardware) Item Description (1) | Model Number (2) | Equip. Condition Code (3) | Quantity (4) | Monthly Lease Cost (5) | Total Lease Cost (4)X(5) (6) | Extra-Use Hourly Rate (7) | Maintenance Charges | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Prime Shift Operation (8) | 2-Shift Operation (9) | 3-Shift Operation (10) |
| TOTALS: | | | | | | | | | |
| Monthly Lease | | | | | | | | | |
| Hourly Usage Charges | | | | | | | | | |
| Monthly Maintenance | | | | | | | | | |

FIGURE 31-2. EQUIPMENT LEASE AND MAINTENANCE COSTS

7. Other. List and separately identify any other costs related to site preparation not shown above.

(b) Cables. Indicate costs for cables other than those furnished without separate charge by the contractor for the initial installation (including costs for special cable lengths) or external cables required for a unit to be installed through walls, doors, or floors.

(c) Subtotal Site Preparation. Show a subtotal for site preparation for each fiscal year involved. Enter the total of columns 2-9 in column 10.

(2) Utilities.

(a) Temperature and Humidity Control. List costs for air-conditioning and other air-filtering systems necessary for maintaining proper temperature and relative humidity levels.

(b) Power Requirements. Enter costs for principal power requirements and other associated requirements. (See chapter 24, table 24-13.)

(c) Subtotal Utilities. Enter subtotals for utilities for each fiscal year. Enter the total of columns 2-9 in column 10.

(3) Government Personnel. Enter the costs for military and civilian personnel required to operate the system per year. Both rates should reflect those used in conducting economic analyses.

(a) Military Pay and Allowances. For costs of military personnel, see chapter 23, table 23-2.

(b) Civilian Salaries and Overtime. For costs of civilian personnel, see chapter 24, table 24-1.

(c) Subtotal Government Personnel. Enter the total of columns 2-9 in column 10.

(4) Operating Supplies. Enter costs for operating supplies; e.g., paper, tapes and tape reels, disks.

(5) Total Nonequipment Costs. Enter the total of (1) through (4) in columns 2 through 10.

| Software and Services Item Description (1) | Total Proposed Quantity (2) | Unit Purchase Price (3) | Total Purchase Price (2)X(3) (4) | Monthly Charges | | | Total Annual Charges 12X(7) (8) |
|---|---|---|---|---|---|---|---|
| | | | | Description (5) | Unit Price (6) | Total (2)X(6) (7) | |
| TOTALS: | | | | | | | |
| Purchase | | | | | | | |
| Annual Charges | | | | | | | |

FIGURE 31-3. VENDOR SOFTWARE AND SERVICES COSTS

7. Instructions for General Costing Considerations Narrative. The following considerations are addressed to selected aspects of the cost data supporting the ADP cost estimate. Response to these items should be in narrative form, keyed to each of the points identified below.

a. Basic and Extra Use Costs.

(1) State the number of hours per month constituting the basic shift, and explain in detail how operational use time is measured and costed.

(2) If extra-shift use of one component or one category of components creates costs associated with other components or categories of components, explain the details of such costs.

b. Maintenance Proposed. Explain maintenance contract terms, conditions, and prices as they relate to the proposed equipment for either onsite maintenance or oncall maintenance both during and outside the PPM. Provide the specific GSA Federal Supply Schedule Price List, if applicable, or other official source documentation covering the proposed maintenance plan.

c. Training Services. Indicate in figure 31-3 the specific items of Government-furnished equipment, facilities, or personnel required to support the proposed training, and the basis for the costing of these items.

d. Transportation. Explain the provisions for transporting the equipment to the site where it is to be installed, identifying the total cost expected to be incurred. If Government-furnished transportation services or equipment is required, include estimated costs for these services in the total systems cost and explain the rates or other basis for the derivation of these costs.

e. Installation. Explain the provisions for installing the equipment and indicate the expected cost necessary for the equipment installation. If Government-furnished installation services or equipment is required, include the estimated costs for these items in the total systems cost and explain the basis for the derivation of these costs.

f. Other Costs. Explain any other costs used in preparing this system estimate not covered in the preceding categories, or other costing considerations which would serve to clarify the estimate.

| Cost Element (1) | FY-1 (2) | FY-2 (3) | FY-3 (4) | FY-4 (5) | FY-5 (6) | FY-6 (7) | FY-7 (8) | FY-8 (9) | Total of Columns 2-9 (10) |
|---|---|---|---|---|---|---|---|---|---|
| 1. Site Preparation | | | | | | | | | |
| a. Building Requirements | | | | | | | | | |
| (1) Floor Construction | | | | | | | | | |
| (2) Acoustical Treatment | | | | | | | | | |
| (3) Lighting | | | | | | | | | |
| (4) Safety Equipment | | | | | | | | | |
| (5) Air Conditioning | | | | | | | | | |
| (6) Space Requirements | | | | | | | | | |
| (7) Other | | | | | | | | | |
| b. Cables | | | | | | | | | |
| c. Subtotal Site Preparation | | | | | | | | | |
| 2. Utilities | | | | | | | | | |
| a. Temperature and Humdity Control | | | | | | | | | |
| b. Power Requirements | | | | | | | | | |
| c. Subtotal Utilities | | | | | | | | | |
| 3. Government Personnel | | | | | | | | | |
| a. Military Pay and Allowances | | | | | | | | | |
| b. Civilian Salaries and Overtime | | | | | | | | | |
| c. Subtotal Govt Personnel | | | | | | | | | |
| 4. Operating Supplies | | | | | | | | | |
| 5. Total Nonequipment Costs | | | | | | | | | |

FIGURE 31-4. NONEQUIPMENT COSTS

8. Instructions for Figure 31-5: Time-Phased Cost Summary.

a. Column 1: Cost Element. This column is a consolidation of major items detailed in previous figures. The sum of the identified items should reflect the total ADPE acquisition being costed. Note that costs for elements 8, 9, 10, and 11 must be converted to annual charges for this summary.

b. Column 2: Reference Figure. This column indicates the specific format from which the items indicated in column 1 were extracted.

c. Column 3: Explanation. This column is provided for noting the derivation of any reference used to assist in calculations, sources for evaluations, documentation, procedures, factors, etc.

d. Columns 4-11: Fiscal Years 1-8. All annual funds should be shown in the applicable column for the fiscal year when they will be required. FY 1 should represent the first project fiscal year in which funds are required. The discount factors shown for each fiscal year in row 18 should be multiplied by the Total System Costs in row 17 to calculate Total System Discounted Costs for row 19.

e. Column 12: Sum (4-11). Enter the total annual fund requirements for the project. There is no entry in row 18 for this column.

9. Cost Factors for Utilities and Operating Personnel.

a. The costing procedure which can be used to estimate the annual cost of utilities is as follows:

Annual Cost of Utilities = 12 X H X (KE + KA) X EC.

With,

H = Monthly operational hours based on extrapolated live test demonstration timing.

KE = Number of kilowatts of power used by the proposed equipment.

KA = Number of kilowatts of power used for air-conditioning. A conversion factor of 1.5 kilowatts per 12,000 Btu's will be used to convert Btu's to kilowatts for determination of KA.

EC = Cost of commercial electricity per kilowatt hour from table 24-13.

| Cost Element (1) | Reference Figure (Column) (2) | Explanation (3) | Annual Fund Requirements FY-1 (4) | FY-2 (5) | FY-3 (6) | FY-4 (7) | FY-5 (8) | FY-6 (9) | FY-7 (10) | FY-8 (11) | SUM(4-11) (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Equipment Purchase | 31-1(6) | | | | | | | | | | |
| 2. Site Preparation | 31-4-(1)c | | | | | | | | | | |
| 3. Transportation | | | | | | | | | | | |
| 4. Installation | | | | | | | | | | | |
| 5. Software/Services Purchases | 31-3(6) | | | | | | | | | | |
| 6. Other Nonrecurring Charges | | | | | | | | | | | |
| 7. Subtotal Nonrecurring Charges (1 thru 6) above | | | | | | | | | | | |
| 8. Equipment Lease Charges | 31-2(6) | | | | | | | | | | |
| 9. Basic Equipment Maintenance (Purchase Equipment) | 31-1(7-9) | | | | | | | | | | |
| 10. Basic Equipment Maintenance (Leased Equipment) | 31-2(8-10) | | | | | | | | | | |
| 11. Extra Use Charges | 31-2(7) | | | | | | | | | | |
| 12. Utilities | 31-4-(2)c | | | | | | | | | | |
| 13. Government Personnel | 31-4-(3)c | | | | | | | | | | |
| 14. Operation Supplies | 31-4-4 | | | | | | | | | | |
| 15. Software/Serv Annual Charges | 31-3(8) | | | | | | | | | | |
| 16. Subtotal Recurring Charges (8 thru 15) above | | | | | | | | | | | |
| 17. Total System Costs (7+16) above | | | | | | | | | | | |
| 18. Discount Factor | | DCAI 600-60-1 | X.954 | X.867 | X.788 | X.717 | X.651 | X.592 | X.538 | X.489 | |
| 19. Total System Discounted Cost | | | | | | | | | | | |

FIGURE 31-5. TIME-PHASED COST SUMMARY

b. The method for estimating the costs of Government operation and maintenance personnel is as follows:

Cost of Personnel/Year = A X B X C

A = Pay and allowances of computer operators (see chapters 23 and 24).

B = Number of computer center personnel required per shift. Specify the number and function of these persons. Personnel requirements are to be based on the proposed equipment. Normally an extrapolated live test demonstration timing of benchmark programs determines the number of required operational hours.

C = Number of shifts proposed for each category of personnel.

c. Personnel requirements for operation of remote terminals should be excluded. If a different method of arriving at personnel costs is used, or any different factors are used, substantiating data should be submitted in the general costing consideration narrative.

d. The personnel costs will include the cost of personnel required to operate the computer per shift.

# CHAPTER 38. ECONOMIC ESCALATION

1. General. The preparation of cost estimates for systems and programs involving the acquisition of major communications equipment potentially serves three distinct purposes. These purposes are economic analysis and program evaluation conducted to assist managers in identifying the best new programs and projects to be adopted; comparative cost analysis in a commercial or industrial activities study to determine the relative costs of obtaining products and services from in-house Government and private commercial sources; and estimates of resource requirements included by DoD components in program and budget documentation and requests.

a. The cost estimates used in responding to each of these three purposes are usually unique. An estimate prepared for one purpose cannot, as a general rule, be used without adjustment for other purposes.

(1) Economic analyses and program evaluations accomplished in accordance with DCAI 600-60-1 (DoDI 7041.3 and OMB Circular A-94) are based upon total life cycle program costs, which are discounted (see chapter 41) and which reflect the consideration of economic escalation in all dollar costs included in the estimate.

(2) In the case of comparative cost analyses of commercial or industrial activities accomplished in accordance with DCAI 600-70-1 (DoDI 4100.33 and associated Cost Comparison Handbook, OMB Circular A-76, and OTP Circular 13), costs are converted to the dollars of each performance year (prorated over appropriate fiscal years) using the escalation factors contained in this chapter, in accordance with annex D to the Handbook.

(3) Program and budget cost estimates which identify future total obligation authority (TOA) for the DoD components within the Five Year Defense Program (FYDP), President's budget, and congressional appropriation acts require special procedures. Costs for all years covered by the program or budget (not necessarily the total life cycle) should initially be based upon prices and price levels prevailing during the fiscal year in which the estimate is prepared. All procurement, R&D and military construction costs, and O&M costs exclusive of civilian personnel should be adjusted to include estimates of economic escalation for all years being considered. In accordance with current Office of Management and Budget (OMB) and DoD policy, military and civilian pay and allowances are not adjusted for economic escalation, but reflect the price level costs in effect during the budget year. None of the budget estimate costs for any of the appropriations are discounted. Also, the costs being considered in the budget estimate prepared to support the DCS are limited to those reflected in the program elements of the FYDP Telecommunications Subsystem.

b. In accordance with current DoD budget guidance, estimates of price level changes affecting program acquisition costs will be based upon the index presented in table 38-3. The only exception to this rule will be the

case where an individual program manager has specific contractual arrangements with the prime contractor through contract options or multi-year contracts.

c. The TOA estimated for a particular year should reflect the price level changes over the total span of years that procurement will be affected by these changes. For example, the estimated cost in FY 1984 for a procurement of microwave terminals might actually cover contractor effort which will take place through FY 1986. The time delay in the actual expenditure of the funds for the terminals provides for the phasing of outlays and successive contracts for the equipment and other procurement-related services involved. In the budgetary sense, the TOA would reflect FY 1984 as the year the funds were required, but the economic escalation included in those funds would reflect expected price level changes through FY 1986.

d. As with the determination of the expected price levels themselves, estimates of the time phasing of actual expenditures should be based on the data presented in table 38-2 except when expected contractor payment patterns of specific programs are known. Unless neither the projected price levels nor the time phasing of the expenditures can be based on specific contractual data, table 38-3 should be used. This table is based upon the general price levels presented in table 38-1 and the expenditure rates of table 38-2.

2. Use of Tables.

a. Table 38-1 presents estimates of past and future price levels for nonrecurring development and procurement of equipment items and services, military construction, recurring operating and maintenance costs excluding civilian personnel pay and benefits, pay and allowances for military personnel, and basic pay and benefits for GS civilian personnel. If indexes are required beyond the last year shown in the table, they may be derived by compounding the rate shown in the table. For a technique incorporating both economic escalation and discounting, refer to chapter 41.

(1) The use of these indexes in preparing final program budgets involves special treatment of the estimates. (See paragraph 1a.)

# (2) Table 38-1 should be used for adjusting procurement, RDT&E, construction, and O&M (exclusive of civilian personnel) dollars to constant dollars for budgetary purposes. When current estimating factors are not available and a prior year is used as the base year, use the indexes to increase the base year costs to budget year costs. For example, current year FY 79 RDT&E costs are translated to current year 1984 costs by multiplying by (100.0/69.4).

# (3) Table 38-1 may be adjusted to a different base year from that indicated by dividing each column by the index in that column opposite the desired base year.

#

TABLE 38-1. PRICE LEVEL INDEXES

| FISCAL YEAR | PURCHASES | | | | PAY & ALLOW | |
|---|---|---|---|---|---|---|
| | PROC | RDTE | MILCON | O&M | CIV | MIL |
| 1974 | 48.0 | 48.1 | 47.2 | 42.7 | 52.2 | 49.3 |
| 1975 | 52.2 | 53.3 | 54.9 | 51.7 | 56.5 | 52.5 |
| 1976 | 55.6 | 56.8 | 56.5 | 55.2 | 61.2 | 55.2 |
| 1977 | 59.8 | 60.0 | 59.0 | 59.4 | 66.6 | 58.3 |
| 1978 | 63.9 | 64.1 | 63.5 | 63.7 | 71.8 | 62.4 |
| 1979 | 69.4 | 69.4 | 69.4 | 69.4 | 76.1 | 66.1 |
| 1980 | 76.8 | 76.8 | 76.8 | 76.8 | 81.3 | 70.9 |
| 1981 | 84.9 | 84.9 | 84.9 | 84.9 | 88.4 | 82.1 |
| 1982 | 91.4 | 91.4 | 91.4 | 91.4 | 93.2 | 93.4 |
| 1983 | 95.9 | 95.9 | 95.9 | 95.9 | 97.2 | 97.1 |
| 1984 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1985 | 104.9 | 104.9 | 104.9 | 104.9 | 102.9 | 105.5 |
| 1986 | 109.7 | 109.7 | 109.7 | 109.7 | 108.8 | 111.3 |
| 1987 | 114.4 | 114.4 | 114.4 | 114.4 | 115.1 | 118.0 |
| 1988 | 119.0 | 119.0 | 119.0 | 119.0 | 121.5 | 124.7 |
| 1989 | 123.4 | 123.4 | 123.4 | 123.4 | 128.1 | 131.4 |
| 1990 | 128.0 | 128.0 | 128.0 | 128.0 | 135.0 | 138.5 |
| 1991 | 132.7 | 132.7 | 132.7 | 132.7 | 142.3 | 146.0 |
| 1992 | 137.6 | 137.6 | 137.6 | 137.6 | 150.0 | 153.9 |
| 1993 | 142.7 | 142.7 | 142.7 | 142.7 | 158.1 | 162.2 |
| 1994 | 148.0 | 148.0 | 148.0 | 148.0 | 166.6 | 170.9 |
| 1995 | 153.5 | 153.5 | 153.5 | 153.5 | 175.6 | 180.2 |
| 1996 | 159.2 | 159.2 | 159.2 | 159.2 | 185.1 | 189.9 |
| 1997 | 165.1 | 165.1 | 165.1 | 165.1 | 195.1 | 200.1 |
| 1998 | 171.2 | 171.2 | 171.2 | 171.2 | 205.6 | 210.9 |
| 1999 | 177.5 | 177.5 | 177.5 | 177.5 | 216.7 | 222.3 |
| RATE | 3.7 | 3.7 | 3.7 | 3.7 | 5.4 | 5.4 |

NOTES: BASE - FISCAL YEAR 1984. PROCUREMENT, RDT&E, MILCON, AND O&M INDEXES EXCLUDE PAY AND FUEL.

SOURCE: "DOD DEFLATORS (OUTLAYS)," 3 JAN 84, AND OASD(C) MEMO, "PRICE ESCALATION INDICES," 4 JAN 84.

# b. Table 38-2 should be used to estimate the rates of outlay or expenditure by type of budget appropriation so that, in projecting future prices, the estimated program cost will reflect the estimated price escalation over the time period during which the outlay will be expended. The rows indicate the part of the appropriation which is expended in the first, second, and successive years. The columns under each appropriation refer to the initial fiscal year of the outlay, and the row values under each column indicate the fraction of expenditure in that and subsequent fiscal years. For example, procurement funds will be outlaid as follows: 19 percent in the first year, 40 percent in the second, 29 percent in the third, etc. This procedure of recognizing the timelag in expenditure rates generally has the effect of materially increasing the price level rate of change identified for a given year. For example, a cost estimate made in FY 84 for RDT&E funds in the amount of $2,800 in an FY 84 program with price level increases estimated at 5 percent per year would result in program costs as follows:

| FY | Dollars | | Percent of Outlay | | Inflation Rate | | Adj Dollars |
|---|---|---|---|---|---|---|---|
| 1984 | - | | - | | 1 | | |
| 1985 | $2,800 | X | .49 | X | 1+.05 | = | $1,441 |
| 1986 | 2,800 | X | .43 | X | $(1+.05)^2$ | = | 1,327 |
| 1987 | 2,800 | X | .07 | X | $(1+.05)^3$ | = | 227 |
| 1988 | 2,800 | X | .01 | X | $(1+.05)^4$ | = | 34 |
| | FY 1984 Adjusted Estimate | | | | | | $3,029 |

Percent Inflation Included [($3,029 - $2,800)/$2,800] = 8.2%

# TABLE 38-2. PROGRAM EXPENDITURE RATES

| FISCAL YEAR | APPROPRIATION | | | | |
|---|---|---|---|---|---|
| | PROCUREMENT | RDTE | MIL. CONSTR. | O&M | MIL. & CIV. PAY & ALLOW. |
| FIRST | .19 | .49 | .15 | .80 | 1.00 |
| SECOND | .40 | .43 | .38 | .19 | |
| THIRD | .29 | .07 | .18 | .01 | |
| FOURTH | .07 | .01 | .14 | | |
| FIFTH | .05 | | .08 | | |
| SIXTH | | | .07 | | |

SOURCE: OUTLAY RATES -DEFENSE AGENCIES, POM PREPARATION INSTRUCTIONS, OASD(P&E), 29 MAR 84.

c. Table 38-3 reflects a combination of the information presented in tables 38-1 and 38-2. This table is appropriate for use when both the expected economic escalation and the anticipated rate of expenditure are to be included in the estimate, unless specific program contractual data for either are available. Table 38-3 should not be used in conjunction with discounting.

(1) The price level indexes presented in table 38-1 have been adjusted by the appropriate outlay time-phasing factors from table 38-2. The adjusted indexes presented in this table should be used as the basis for adjusting program and budget cost estimates for each fiscal year to account for economic escalation.

(2) For example, a program and budget cost estimate for procurement of communications equipment based on constant year FY 84 price levels would be adjusted for economic escalation for FY 85 through FY 87 using table 38-3 as follows:

| | FY 1985 | | FY 1986 | | FY 1987 | Total |
|---|---|---|---|---|---|---|
| Comm. Equipment (FY 1984) | $26,500 | | $8,200 | | $12,500 | $47,200 |
| Economic Escalation Adjustment Factor | X 1.115 | X | 1.162 | X | 1.207 | |
| Total Comm. Equip. | $29,548 | + | $9,528 | + | $15,088 | = $54,164 |
| Inflation (included) | $3,048 | + | $1,328 | + | $2,588 | = $6,964 |

(3) The base year of table 38-3 cannot be shifted by dividing by the index for a different base year. Instead, table 38-1 should be adjusted to the desired base year and then table 38-2 should be applied.

d. When cash flows are to be discounted, the following procedure is appropriate.

(1) The expected outlays are first time-phased by applying table 38-2 to estimated costs.

(2) Outlays are then inflated using table 38-1.

(3) Finally, the discount factors in chapter 41 are applied to obtain present values.

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MANUAL CHANGE 1(U) DEFENSE COMMUNICATIONS AGENCY
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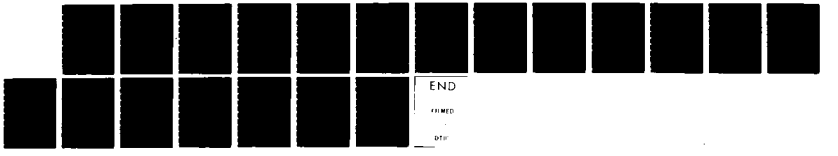

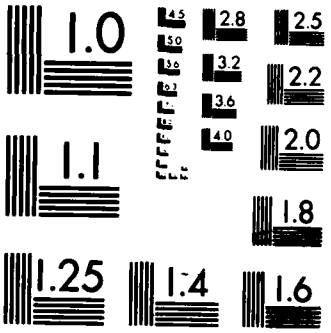

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TABLE 38-3. WEIGHTED (TOA) PRICE LEVEL INDEXES

| FISCAL YEAR | PURCHASES | | | | PAY & ALLOW | |
|---|---|---|---|---|---|---|
| | PROC | RDTE | MILCON | O&M | CIV | MIL |
| 1974 | 53.5 | 51.0 | 56.3 | 44.5 | 52.2 | 49.3 |
| 1975 | 57.5 | 55.4 | 60.1 | 52.4 | 56.5 | 52.5 |
| 1976 | 61.7 | 58.8 | 64.1 | 56.1 | 61.2 | 55.2 |
| 1977 | 66.7 | 62.6 | 69.4 | 60.3 | 66.6 | 58.3 |
| 1978 | 72.7 | 67.5 | 75.7 | 64.9 | 71.8 | 62.4 |
| 1979 | 79.7 | 73.9 | 82.4 | 71.0 | 76.1 | 66.1 |
| 1980 | 86.8 | 81.5 | 89.0 | 78.5 | 81.3 | 70.9 |
| 1981 | 92.7 | 88.6 | 94.8 | 86.3 | 88.4 | 82.1 |
| 1982 | 97.5 | 94.1 | 99.6 | 92.3 | 93.2 | 93.4 |
| 1983 | 102.0 | 98.4 | 104.1 | 96.8 | 97.2 | 97.1 |
| 1984 | 106.7 | 102.9 | 108.8 | 101.0 | 100.0 | 100.0 |
| 1985 | 111.5 | 107.8 | 113.5 | 105.9 | 102.9 | 105.5 |
| 1986 | 116.2 | 112.5 | 118.2 | 110.7 | 108.8 | 111.3 |
| 1987 | 120.7 | 117.2 | 122.8 | 115.4 | 115.1 | 118.0 |
| 1988 | 125.3 | 121.7 | 127.4 | 119.9 | 121.5 | 124.7 |
| 1989 | 129.9 | 126.2 | 132.1 | 124.4 | 128.1 | 131.4 |
| 1990 | 134.7 | 130.8 | 137.0 | 129.0 | 135.0 | 138.5 |
| 1991 | 139.7 | 135.7 | 142.0 | 133.8 | 142.3 | 146.0 |
| 1992 | 144.9 | 140.7 | 147.3 | 138.7 | 150.0 | 153.9 |
| 1993 | 150.2 | 145.5 | 152.7 | 143.8 | 158.1 | 162.2 |
| 1994 | 155.8 | 151.3 | 158.4 | 149.2 | 166.6 | 170.9 |
| 1995 | 161.6 | 156.9 | 164.3 | 154.7 | 175.6 | 180.2 |
| 1996 | 167.5 | 162.7 | 170.3 | 160.4 | 185.1 | 189.9 |
| 1997 | 173.7 | 168.7 | 176.6 | 166.3 | 195.1 | 200.1 |
| 1998 | 180.2 | 175.0 | 183.2 | 172.5 | 205.6 | 211.0 |
| 1999 | 186.8 | 181.5 | 190.0 | 178.9 | 216.7 | 222.3 |

NOTE: BASE - FISCAL YEAR 1984.

SOURCE: TABLES 38-1 AND 38-2; DCA CODE 65C, APR 84.

# CHAPTER 39. LEASE VERSUS BUY

1. Introduction. This chapter addresses the factors involved in determining whether to purchase or lease equipment. Several noneconomic factors are evaluated as well as the economic ones. Data is presented for estimating lease and maintenance charges as percentages of purchase price. Finally, an analytical procedure is provided for comparing the relative economic desirability of lease or purchase.

2. Noneconomic Factors. The primary consideration in a lease or buy decision is usually economics; however, noneconomic factors also can be important and may even dominate the decision. These factors can be grouped under the following categories: (a) performance, (b) logistics, and (c) other. The discussion here is intended to aid by giving a list of factors that have been considered in previous lease or buy decisions. The decision-maker must still subjectively evaluate the extent to which each factor applies to the case and whether the factor suggests a lease, a buy, or is neutral. Many apparently noneconomic factors can and should be considered in terms of their cost impact; for example, the factor "rate of technological change" should be considered as an influence on the economic life. As another example, a lack of "Integrated Logistics Support (ILS)" overseas should be evaluated in terms of the increase required in initial spares, spare parts, end items, and Government maintenance personnel. There is a detailed discussion of each of the factors listed in table 39-1 in the study referenced. For further details see that study or contact the DCA Cost and Economic Analysis Division.

a. Performance Factors. Table 39-1 lists the factors identified under this category.

(1) Degree of militarization, refers to the extent to which the item's usefulness is limited to the military community, as opposed to commercial users. One of the major risks to a contractor is a lack of other potential lease customers for the military-specific equipment if the Government terminated the lease. To protect the contractor against this risk, contracts may provide for a Basic Termination Liability (BTL) or for high monthly charges. In this situation it is often economically desirable for the Government to check its assumptions about the item's economic life, assume the risk, and then buy.

(2) Site location can also influence the lease or buy decision. Equipment in a mobile site may need to be militarized or require Government maintenance. Either militarization or Government maintenance suggests a buy decision. Equipment in a fixed site may not require militarization or Government maintenance, in which case the site location factor is neutral. For sites outside CONUS, consider who will perform the equipment maintenance and then evaluate the logistics factors in table 39-1.

(3) A requirement for survivability can be satisfied either by using a commercial item in a protected environment or by militarizing the item. Both approaches should be considered and the economic impact evaluated. A high degree of militarization tends to make a buy decision preferable, but the use of a commercial item in a protected environment makes this factor neutral.

(4) Leasing may be preferred in the case of equipment subject to rapid technological change. The Government's flexibility is enhanced if the lease is structured so that (a) the lessor will have strong financial incentive to incorporate design improvements, and (b) the Government may terminate the lease and acquire updated equipment. This reasoning also applies to software. By leasing software packages for statistical analysis, data base management, and other commercial applications, for example, the Government receives periodic improvements, including the latest user documentation. Before any lease is signed the Government must carefully review the termination clause and analyze the economic impact. Such analysis is especially important with items experiencing rapid technological change.

b. Logistics Factors. Table 39-1 lists the factors relating to logistics. There are advantages in having the owner of the equipment also provide the Operations and Support (O&S). This avoids problems arising when the Government operates and maintains equipment belonging to a contractor. The anticipation of DoD O&S influences the decision toward buying. However, if contractor O&S is planned the logistics factors in table 39-1 tend to be neutral.

c. Other Factors. A variety of other legal and practical considerations are discussed in the referenced study.

(1) The weak financial status of a company may lead to deteriorating maintenance service. To avoid this problem the Government might buy and maintain the equipment. If financial status is a problem, it can be considered either a lease or buy issue or a source selection issue, and the contracting office should be consulted for assistance.

(2) The approach selected (lease or buy) should not arbitrarily exclude small businesses from competing.

(3) Occasionally Procurement funds are not available to buy an item, and sometimes Operations and Maintenance funds are not available to lease the item. Effective planning should aid in avoiding decisionmaking based on the type of funds. Alternatively, other funds should be reprogramed to implement the most desirable approach.

TABLE 39-1. NONECONOMIC FACTORS

Performance Factors
- Degree of militarization
- Site location
- Security requirements
- Survivability requirements
- Reconstitution requirements
- Peacetime availability
- Rate of technological change
- System interfaces
- Growth rate and flexibility

Logistics Factors
- Integrated Logistics Support (ILS)
- Trained O&M personnel
- Operating environment
- O&S performance
- Probability of work stoppage
- Rotation sites
- "AN/" nomenclature
- COMSEC keys

Other Factors
- Financial status of company
- Small business
- Site location
- Procurement and O&M funds
- Multiple lessors
- OTP-13
- Brooks Bill
- DoDD 5000.37
- Federal Property and Administrative Services Act
- OMB Circular No. A-76
- Government contract placement
- Schedule
- Management flexibility
- Performance standards
- Military service user preference
- Connection approval requirements (host nation)
- Defense Acquisition Regulation 1-317

Source: "Guidelines for Making Lease/Buy Decisions Involving Defense Communications System Components," Institute for Defense Analysis, Jan 84, IDA Paper P-1696.

3. Estimating Lease Costs. This paragraph presents a procedure for estimating lease costs when actual data cannot be obtained. In most cases, the data should be obtained from vendor catalogs, price schedules, or previous contract proposals.

a. Lease-Purchase Ratios. The factors that influence the size of lease costs relative to purchase costs include: the type of equipment, its age, the manufacturer, the length of the proposed lease, and the position in the price range. Each of these factors is discussed below in terms of its effect on the ratio of annual lease charge to purchase price. For example, a ratio of .36 means that the monthly cost to lease (not including maintenance) is 3 percent (=.36/12) of the initial purchase price. A higher ratio favors purchase and a lower one lease.

(1) Type of Equipment. The most important factor in the lease-purchase ratio is the specific type of equipment. Table 39-2 shows average ratios for several different types.

(2) Age of Equipment. The ratio tends to be reduced with the age of the equipment. Models that have been on the market for several years do not command as high a lease charge. However, this influence is considered to be minimal.

(3) Manufacturer. Different manufacturers offer widely different lease rates for comparable equipment. If it is desirable to lease a particular item of equipment, a third party lease agent may offer a better deal than the manufacturer. In some cases, it may be preferable to lease similar equipment from another manufacturer.

(4) Lease Length. Income guarantees that coincide with longer leases permit lower lease charges. On the average, the annual lease-purchase ratio declines 10 percent for each year on the lease. For example, a 3-year lease would be expected to be 10 percent less than a 2-year lease.

(5) Price. Selections from the high end of the price range for a given type of equipment tend to carry a slightly lower lease-purchase ratio than those at the low end. This may reflect a fixed component of the lease charge for lease administration. However, due to the variability across manufacturers, this factor may be neglected when estimating the ratio.

b. Use of Table 39-2. To estimate a lease or maintenance cost, multiply the ratio in the table for the appropriate type of equipment by the purchase price of that equipment. The result is the approximate annual lease cost (excluding maintenance) for a 2-year lease or the approximate annual maintenance cost. To find the monthly charge, divide by 12. For a 1-year lease, increase the derived lease charge by 10 percent; for up to a 5-year lease, decrease it by 10 percent per year.

TABLE 39-2. LEASE AND MAINTENANCE RATIOS

| Equipment Type | Ratio of Annual Charges to Purchase Price: Lease* | Maintenance |
|---|---|---|
| Terminals | | |
| Keyboard/Printer | .48 | .20 |
| Alphanumeric Display | .46 | .12 |
| Intelligent Systems | .37 | .11 |
| Modems | .40 | |
| Printers | .36 | |
| Over $8,000 | | .16 |
| $4,000 - $8,000 | | .06 |
| Storage Devices | | |
| Disk Drives | .36 | .05 |
| Tape Drives | .26 | .12 |
| Tape Controllers | .32 | .07 |
| Word Processors | | .12 |
| Standalone | .48 | |
| Multiterminal | .37 | |
| Small Business Computers | .27 | |
| Minis | | .11 |
| Micros | | .14 |

* Assumes a 2-year lease without maintenance. Ratio decreases approximately 10% per year of lease length.

Source: Ratios are industry averages; DCA Code 690, Mar 84.

4. Estimating Maintenance Costs. As with lease costs, charges for prime period maintenance vary by type of equipment. Typical rates charged by equipment manufacturers are shown in table 39-2. In addition, third-party service contracts are frequently available.

5. Economic Analysis.

a. General. This paragraph assists in the determination of a lease versus buy break-even point within the economic life of the equipment. This point reflects that time when cumulative discounted lease charges are equivalent to cumulative discounted purchase costs less the discounted residual value. If the equipment is likely to remain in use after this break-even or crossover point, the economic advantage shifts from leasing to purchasing. Table 39-3 can be used with a ratio representing monthly lease cost as a fraction of equipment purchase cost and estimates regarding terminal value and inflation rate in determining a break-even period. The table takes into consideration the annual 10-percent discount rate, adjusted to a monthly rate. Complex alternatives combining lease and purchase, such as the various forms of lease-with-option-to-buy, or contracts requiring basic termination liability payments, are not treated in this paragraph.

b. Use of Table. Table 39-3 is based on the ratio of differential recurring costs to differential investment costs. When the lease charge does not include maintenance, this ratio will usually be the monthly lease charge divided by the purchase price. If maintenance is included in the lease option, the maintenance charge for the purchase case should be subtracted from the lease charge before dividing. After the ratio has been determined, assumptions must be made as to the most likely economic life (see chapter 32) and terminal value of the equipment (salvage value as a percentage of original purchase price) and the economic escalation rate. The table, which is based on accelerated depreciation, can then be used to determine the number of months to the break-even point.

c. Estimating Procedure. Monthly lease-to-purchase ratios from .008 to .027 are indicated down the left-hand column of the table. For smaller ratios, lease is usually preferred; for larger ratios, purchase is preferred. Locate the correct ratio and read across to the column for the appropriate economic life, terminal value, and inflation percentages. The number located will be the number of months required after purchase for the cumulative discounted expenditures for leasing to equal the cumulative discounted expenditures for purchasing the equipment. This number may be adjusted to account for a 3-month warranty, when applicable, by subtracting 80 times the monthly maintenance charge to purchase price ratio times the economic life (in years).

(1) Example 1. An item of equipment, with an estimated economic life of 8 years, has a purchase price of $50,000 and a monthly lease charge of $1,000, which does not include maintenance. There is no warranty. The equipment is assumed to have no terminal value, and the annual inflation rate is estimated at 4 percent. The lease-to-purchase ratio is calculated to be $1,000/$50,000 = .020. Locating this ratio on the left side of the table in the 8-year life section and following the row across to the 0 percent terminal value, 4 percent inflation column, the break-even point is found to be the 38th month. It would therefore be more economical to purchase this equipment if it is to be in use longer than 38 months.

(2) Example 2.

| | |
|---|---|
| Purchase price of equipment | = $189,000 |
| Monthly lease charge (including maintenance) | = $ 3,212 |
| Monthly maintenance charge (if purchased) | = $ 850 |
| Warranty period (if purchased) | = 3 months |
| Estimated economic life | = 12 years |
| Estimated terminal value (in today's dollars) | = $ 20,000 |
| Estimated inflation rate | = 6% |

Since lease includes maintenance, the differential cost is calculated:

$$\text{Lease-to-purchase ratio} = \frac{\$3,212 - \$850}{\$189,000} = .0125$$

The terminal value is approximately 10 percent ($20,000/$189,000 = .106).

(a) Locate the lease-purchase ratio (.0125) on the table. This ratio is between .012 and .013.

(b) Locate the 4 percent and 8 percent inflation rate columns under 12-year life, 10 percent terminal value.

(c) The relevant section of the table is:

| | 4% | 6% | 8% |
|---|---|---|---|
| .012 | 81 | | 41 |
| .0125 | | (?) | |
| .013 | 63 | | 23 |

Since both coordinates are midway between the values shown on the table, the result may be approximated by averaging the four values shown above (81 + 41 + 63 + 23)/4 = 52.

(d) To account for the warranty, subtract $(80 \times \frac{\$850}{\$189,000} \times 12) = 4.3$ from 52 to get a break-even point of 47.7 or 48 months.

TABLE 39-3. NUMBER OF MONTHS TO BREAKEVEN

| Mthly Ls* / Purch | 8-Year Life | | | | | | 12-Year Life | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0% Term Value | | | 10% Term Value | | | 0% Term Value | | | 10% Term Value | | |
| | 0 % | 4 % | 8 % | 0 % | 4 % | 8 % | 0 % | 4 % | 8 % | 0 % | 4 % | 8 % |
| .008 | 96 | 96 | 96 | 96 | 96 | 96 | 144 | 144 | 138 | 144 | 144 | 124 |
| .009 | 96 | 96 | 96 | 96 | 96 | 96 | 144 | 144 | 118 | 144 | 144 | 101 |
| .010 | 96 | 96 | 96 | 96 | 96 | 96 | 144 | 134 | 98 | 144 | 122 | 79 |
| .011 | 96 | 96 | 96 | 96 | 96 | 88 | 144 | 114 | 78 | 144 | 101 | 58 |
| .012 | 96 | 96 | 88 | 96 | 96 | 78 | 135 | 95 | 59 | 126 | 81 | 41 |
| .013 | 96 | 95 | 79 | 96 | 86 | 68 | 115 | 78 | 43 | 104 | 63 | 23 |
| .014 | 96 | 86 | 70 | 96 | 76 | 58 | 97 | 61 | 27 | 86 | 48 | 10 |
| .015 | 94 | 77 | 61 | 87 | 67 | 48 | 80 | 48 | 14 | 69 | 33 | 4 |
| .016 | 85 | 68 | 52 | 77 | 58 | 40 | 66 | 34 | 6 | 53 | 19 | 2 |
| .017 | 76 | 60 | 45 | 68 | 48 | 31 | 52 | 22 | 3 | 41 | 10 | 2 |
| .018 | 68 | 52 | 37 | 59 | 41 | 22 | 41 | 12 | 2 | 29 | 5 | 1 |
| .019 | 60 | 45 | 29 | 51 | 34 | 15 | 30 | 6 | 1 | 18 | 3 | 1 |
| .020 | 52 | 38 | 21 | 44 | 26 | 9 | 20 | 4 | 1 | 10 | 2 | 1 |
| .021 | 46 | 31 | 15 | 37 | 19 | 6 | 12 | 2 | 1 | 5 | 1 | 1 |
| .022 | 40 | 24 | 9 | 30 | 13 | 4 | 7 | 2 | 1 | 3 | 1 | 1 |
| .023 | 33 | 18 | 6 | 23 | 8 | 3 | 3 | 1 | 1 | 2 | 1 | 1 |
| .024 | 27 | 13 | 4 | 17 | 5 | 2 | 3 | 1 | 1 | 2 | 1 | |
| .025 | 22 | 9 | 3 | 12 | 4 | 2 | 2 | 1 | 1 | 1 | 1 | |
| .026 | 17 | 6 | 2 | 8 | 3 | 1 | 1 | 1 | | 1 | 1 | |
| .027 | 12 | 4 | 2 | 6 | 2 | 1 | 1 | 1 | | 1 | | |

| Mthly Ls* / Purch | 16-Year Life | | | | | | 20-Year Life | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0% Term Value | | | 10% Term Value | | | 0% Term Value | | | 10% Term Value | | |
| | 0 % | 4 % | 8 % | 0 % | 4 % | 8 % | 0 % | 4 % | 8 % | 0 % | 4 % | 8 % |
| .008 | 192 | 187 | 121 | 192 | 173 | 97 | 240 | 179 | 80 | 240 | 161 | 48 |
| .009 | 192 | 151 | 87 | 192 | 135 | 61 | 240 | 132 | 40 | 240 | 113 | 13 |
| .010 | 192 | 119 | 55 | 187 | 102 | 32 | 193 | 92 | 10 | 180 | 71 | 3 |
| .011 | 157 | 91 | 30 | 145 | 72 | 10 | 144 | 57 | 3 | 131 | 39 | 2 |
| .012 | 125 | 65 | 10 | 112 | 48 | 3 | 107 | 30 | 2 | 92 | 12 | 1 |
| .013 | 98 | 44 | 4 | 84 | 26 | 2 | 75 | 10 | 1 | 59 | 4 | 1 |
| .014 | 75 | 24 | 2 | 60 | 9 | 1 | 48 | 3 | 1 | 34 | 2 | 1 |
| .015 | 54 | 10 | 1 | 41 | 4 | 1 | 28 | 2 | 1 | 14 | 1 | 1 |
| .016 | 38 | 4 | 1 | 24 | 2 | 1 | 11 | 1 | | 4 | 1 | |
| .017 | 22 | 2 | 1 | 10 | 1 | 1 | 4 | 1 | | 2 | 1 | |
| .018 | 10 | 2 | 1 | 4 | 1 | | 2 | 1 | | 1 | 1 | |

Notes:
* Lease excluding maintenance (i.e., difference in recurring costs between lease and purchase options)
Table is applicable for economic lives of 8, 12, 16, or 20 years, 0% or 10% terminal value, and 0%, 4%, or 8% inflation.
For higher lease/purchase ratios, breakeven is within one year.
To account for a 3-month warranty, use the table value less (80 X mtce/purch X econ life in yrs)

Source: DCA Code 690.

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